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OF

WESTERN AUSTRALIA.

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PROGRESS.

(THE EDITOR.)

It was an unkind stroke of Fate that gave to this season a light and delayed rainfall in many of the wheat-farming areas, just when the farmer most needed encouragement in his spirited efforts to make a record-breaking production. It is a consoling fact that despite this reverse the season's production will not fall far short of last year's harvest, and over 34,000,000 bushels are estimated. It speaks highly for the intelligence of the modern farmer that this result has been accomplished, as, in the circumstances, it only could be by the adoption of skilful husbandry and applied science in tillage. There was a time when the old type agriculturist turned a deaf ear to the admonitions of the scientist and shook his more or less hoary head with a sceptical smile when proferred counsel by those who made it their business to experiment for his benefit. The old methods were good enough for him. What applied to the experimental plot could not be applied to his broad acres. He was a practical man, and knew as did his father before him, that good and bad seasons there always would be; it was in the order of things ordained that there should be lean years and plenty years, and he must bow to the inevitable and take his annual gamble with the seasons. He had many virtues, this old farmer, not the least of which was his dogged perseverance—his indifference to the frowns of fortune. He was never quite down and out, was always up before the count, and his "come back" was continuous. When fortune favoured him with a good season he forgot all the bad, and enjoyed the success he reaped as a result of his labours. When fortune frowned he grumbled, but he did not sit down at his work. He fed his horses just the same, worked harder,

took up an extra hole in his belt and lived on hominy and pumpkin till he got a good harvest. Adversity could bend him, make his tongue sharper and his eye less bright, but it could neither humiliate nor break him. But there was one thing he would not and could not tolerate—advice as to how he should till his farm. We owe much to that lion-hearted type of settler, but apart from his pioneering work we have received but little benefit from his experience. Still he deserves well of our sympathy, for he carved out his destiny under conditions that would quell anything less than a dauntless heart. His means of communication were limited, and sparse newspapers were concerned more with representing to him the happenings of the outside world rather than devoting columns to the advancement that was taking place in cultivation and farm practice. Such enlightment as he received was spasmodic, and not always dependable or applicable to his own climate and environment. Little wonder that he viewed with suspicion new fangled notions about growing crops. Happily these conditions have changed for the better, and the modern farmer realises that the methods recommended by expert advisers are all to his advantage. Scepticism has disappeared, and is displaced by anxiety to learn the latest intelligence in respect to his vocation. The result is reflected in the harvest, for had the old-time stand-as-we-are policy maintained it is undoubtable that there would have been a considerable falling off in this year's wheat crop compared with that of the 1927-28 season. The results of the crop competitions and the experiments carried out at the experiment farms throughout the State, as published in this issue, afford valuable lessons to our readers. There is no need to be discouraged. Western Australia is blessed with a climate that is not variable to any great extent, and with a better season to come we may confidently expect a heavy increase in our centenary year yield. Farmers should redouble their efforts to bring this about. To those who have been unfortunate this season let the memory of that pluck and perseverance that characterised their antecedents inspire them to emulate the unwavering courage, bearing in mind that they can bring to their aid the knowledge diffused as a result of up-to-date experiment and practice. A man may work hard and accomplish little, but hard work when intelligently directed will perform wonders.

A NEW NOXIOUS WEED.

(*Berkheya carduiformis*, D.C.)

C. A. GARDNER,
Government Botanist.

This thistle-like plant, proclaimed a Noxious Weed for the State of Western Australia, is apparently confined to a small area in the vicinity of Hamelin Bay, at Karridale. It is a native of South Africa, and was probably introduced at Hamelin Jetty in the ballast carried by timber boats. Since these boats have not called since 1914, it is fairly safe to assume that the plant has been established here for at least fourteen years.

Mr. G. Gauntlett, an Agricultural Adviser attached to the Dairy Branch of the Department of Agriculture, in reporting upon the condition of this weed, states that the area covered by the plant is about one and three-quarter miles in length by about 300 yards in breadth. It is growing in the sand dunes, and appears to prefer sheltered places although, at the same time, growing in open situations. Two plants seen by Mr. Gauntlett growing in close proximity were twenty-four feet in circumference. The plants are said to be advancing inland at the rate of about half a mile per year. Fire appears to keep the weed in check, since where timber stacks had been burned some years ago, no thistles were found.

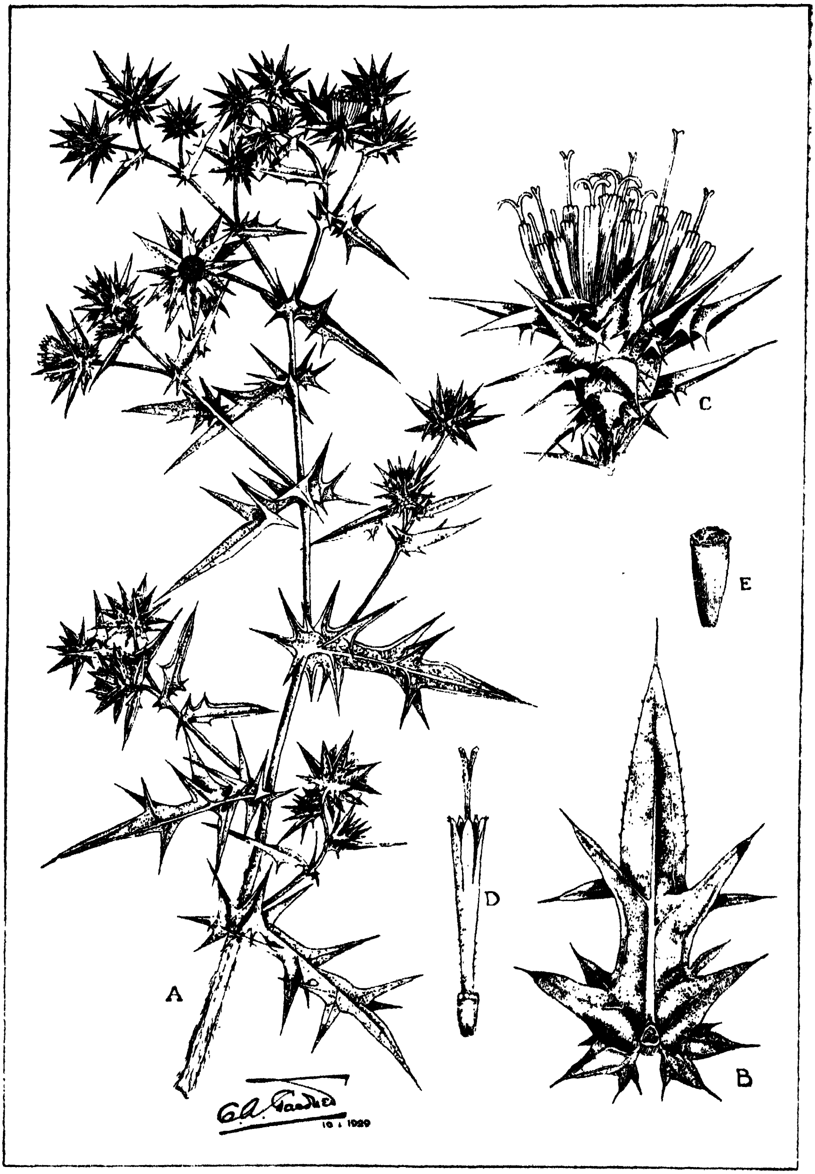
Berkheya carduiformis, as far as can be ascertained, is not a gregarious plant in its own country, and has not been previously recorded as naturalised in any other country, or State of Australia. The plant resembles a thistle, particularly the Star Thistle, and is quite as forbidding by reason of the sharp spines of the leaves and flower heads. In addition to spreading by means of seeds, the plant spreads vegetatively. The older stems in time become bent, and where they come in contact with the soil they root and give rise to new plants. In this way, it is possible for one plant to cover quite extensive areas in the course of time. Each plant, therefore, if allowed to develop, becomes a colony, the whole forming a densely matted intricate mass.

Fortunately, the weed has appeared in one locality only, so that it will be possible to keep a close watch over it, and completely eradicate it. At the same time, there is the possibility that seeds may have been carried by various agencies, and if so, when recognised, the plants should be instantly destroyed, since we have in this plant a species which, if left to itself, may, with a suitable environment, spread to an alarming degree. The plant has been grown in Perth for two years, and has successfully withstood the dry summer in poor sandy soil.

Description of the Plant.

A thistle-like plant, 2-3 feet in height, and up to six feet in diameter, with several erect or spreading stems, which sometimes develop into stolons. Leaves rigid, pinnatipartite, the lobes terminating in strong pungent spines, often with smaller spines between, the margins recurved; the radical leaves very long, tapering at the base and subsessile, the stem leaves shorter, the uppermost very short and decurrent in spiny stem-wings. Heads small, dis-

coid, subcorymbose or panicled; the peduncles and bases of the involucres woolly. Involucre of spiny-toothed bracts with recurved margins. Receptacle honeycombed, the cells with rather long bristles. Florets yellow; filaments smooth; achenes glabrous, obconic, crowned by a pappus consisting of a short cup irregularly split. Flowering season November-December. The



Berkheya (*Carduiformis*, D.C.).

achenes are small and black when mature. They do not readily fall out of the involucre, but remain in the pockets of the honeycombed disc. After the achenes mature, the whole involucre falls from the plant. Its spiny nature renders it easily picked up by animals in passing, and the achenes fall out as the involucre is carried or rolled. Unlike many plants of the same family the seeds are not distributed by wind.

Berkheya cardui formis, D.C.

Explanation of Plate.

A. Habit of Plant—½ natural size.
B. Upper leaf—natural size.
C. Involucre—natural size.
D. Floret—twice natural size.
E. Achene ("Seed")—twice natural size.

"THE JOURNAL OF AGRICULTURE"

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THE EARLY VARIETIES OF SUBTERRANEAN CLOVER.

By A. B. ADAMS, B.Sc. (Ag.).

(Four varieties of Subterranean Clover are known. These are First Early, Second Early, Mid-Season and Late. The writer deals with the first two.)

In the article on Subterranean Clover "Journal of Agriculture, W.A." (Vol. 4, page 524) a second early variety found at Muresk is mentioned, but it is stated that nothing is known of its origin. Examination and comparison show that this form is identical with that grown by Mr. Monger at "Daliak." Mr. Cotton has since stated that Mr. Monger supplied him with two bags of clover burr in 1921. It is therefore established that the early variety found at Muresk originated at "Daliak": beyond this its origin cannot be traced. All that is known is that it appeared at "Daliak" and, being suited to the district, spread over the greater part of the property. Sheep have been the chief agents in spreading the seed, but topdressing has given the vigorous growth and luxuriant pastures.

At Muresk we have both the early varieties, viz., the first early from Mr. P. D. Forrest of Boyup Brook and the second early from Mr. A. J. Monger of York. As they are growing under similar conditions it is possible to draw comparisons. The following table sets out the effect of seasonal conditions:—

Year.	First Early.	Second Early.
1927, with first effective rains on May 6.	Flowered August 13.	Flowered last week in August.
1928, with first effective rains on May 29.	Flowered August 20.	Flowered first week in September

It will be seen that seasonal conditions affect the time of commencement of flowering.

The time when the plants cease to flower appears to be chiefly controlled by the soil moisture. On November 12th the first early plants were still growing and flowering where the soil was moist: but where the soil was dry the plants had withered. Nevertheless it would appear that there is a definite date for the cessation of growth because by the end of the first week in December even the plants on moist soil had dried up.

In addition to the points of difference previously recorded between the first early and mid-season varieties there is a further difference in seeding habits. If the ground is dry the plants of either variety fail to bury their seed. If, however, the ground is shaded by the leaves of the plants the mid-season will set seed in the burrs lying on the surface. These surface seeds are as large and as well developed as those in the buried burrs. The early varieties form little seed on the surface although while the ground is still moist they flower and seed prolifically. It is essential in these varieties that the flowers must be able to bury themselves.

Since the early varieties form a negligible amount of seed on the surface it is to be expected that their seed will be rather more expensive than the mid-season. It is necessary to scratch the seed from the ground with a cultivator before they can be swept up. It must not be inferred that the seeds of

the early varieties will not be available to stock, as Mr. Monger states that his sheep scratch the burrs out of the ground and feed on them. The sheep digest much of this seed but not all. It is the undigested seed which is largely responsible for spreading the clover over "Daliak." At Muresk much the same thing has happened, for the swept burr received from Mr. Monger was sown in the railway paddock. At the present time plants of this variety are found at the opposite end of the farm.

Although it is a fact that sheep utilise much of the seed, passing a small percentage in the droppings in an undigested condition, and these seeds that have resisted the digestive action of the animal are a means of spreading the plant into fresh areas, it must not be thought that it is safe to stock a young subterranean clover pasture heavily with sheep.

Probably many failures to establish such pastures, or a long delay in obtaining a satisfactory one, are directly due to overstocking with sheep in the first year or two after sowing. To overstock, even with cattle, is a bad practice, but sheep bite so closely that they are able to nip off the comparatively large seed leaves of Subterranean Clover and so kill the seedling.

Whenever an attempt is made to establish annual plants as a pasture it is advisable to graze very lightly if at all in the first season in order to produce as much seed as possible. With subterranean clover this is very profitable and necessary as the plants are able to send out long runners and bury their seed well away from the parent plant. This helps to fill up the bare places.

One reason that this plant has been so successful is because it is aggressive, that is, able to grow among other plants given suitable conditions as to soil and climate, and not only live but thrive and seed prolifically and eventually become the dominant species.

Experience this year confirms the previous idea that it is no kindness to subterranean clover to sow it on an absolutely clean seed bed. Seed of the first early variety was sown with an oat crop and also on a two-year-old stubble containing crowfoot (Erodium), several of the smaller trefoils, with Brome and other grasses.

The oats were very clean of weeds and the long runners of the clover were unable to obtain the amount of shelter that they like. The surface soil dried to form a thin crust and the burrs were unable to pull themselves into the ground, consequently but little seed was formed, and probably most of the plants that grow this coming season will be from hard-shelled seeds that failed to germinate last year.

Where the seed was sown on the stubble the superphosphate with which the seed was mixed caused a luxuriant growth of the herbage mentioned above. Where this growth was thickest was the best stand of Subterranean which took advantage of the congenial shelter and buried much seed. This was due to the shade retaining moisture at the surface and perhaps also partly due to the shade itself being congenial. It is of course possible to overdo the amount of shade; it would not be well to sow seed where a heavy smothering growth of Capeweed was expected; a stand of trefoils, however, is a help rather than a hindrance. In sowing the seed for the first time it should be realised that some shelter is of great help to the young seedling and that the flowering plant is able to set more seed if the ground is shaded.

It cannot be too strongly emphasised that the most profitable treatment of a first year's growth is to keep all stock off until the plants have seeded and died down. And for the second season stock lightly, keeping all stock off until the plants have made strong growth.

Summary.

1. The second early variety of subterranean clover found at Muresk is identical with that grown by Mr. A. J. Monger at "Daliak."
2. The time of commencement of flowering varies with the season, or rather with the time of the first useful rains.
3. Flowering is continuous from its commencement to the time when the soil dries out.
4. Practically all the seeds of the first and second early varieties are buried. Flowers unable to bury themselves do not develop seed satisfactorily. In this way the early varieties differ from the mid-season variety which forms seed on the surface if shaded sufficiently.
5. The early varieties set seed better when the ground is shaded. They should be sown with a good nurse crop or on an existing pasture of trefoil or annual grasses.

CULTIVATION OF ONIONS.

E. T. MORGAN,
Vegetable Inspector.

For the greater portion of the year Western Australia relies on the Eastern States for her supplies of onions. During the months of June, July and August of this year (1928) practically the whole of the requirements of this State were supplied from this source. The quantity imported for 11 months was 2,304 tons, and the value at the port of shipment was £25,165. During the three months mentioned above the local prices soared to £20 and £30 per ton. It will, therefore, be seen that the local demand is great enough to warrant much more extensive planting of this very necessary vegetable.

The onion is believed to have been one of the earliest plants cultivated by man. It was produced so early in the history of the human race that the time and place of its first use are not known. Its immediate wild ancestor has never been discovered with certainty; but whatever its origin the fact remains that it was cultivated in the dim past over a vast area in Southern Asia, and in the Valley of the Nile. The onion is now grown in every civilised country and constitutes a very important article of food.

The plant is easy of cultivation, and is one of the most profitable crops that can be grown. Another point in its favour is that, unlike most other crops, it does not exhaust the soil or require that the land be rested at intervals, but yields heavy crops year after year.

Soil.—The ideal soil for onion culture is undoubtedly a good loam, but there is, perhaps, no crop grown which adapts itself to difference of soils and climates as does the onion. It has been, and is, grown profitably in soils ranging from light sand to heavy clay. In fact, some of the best keeping onions are grown in the heavier land, the great drawback being in the cultivation of such soils, as at certain periods of the year this class of land gets waterlogged and in this state it is nearly impossible to get it into suitable condition for the reception of onion plants. Under irrigation, in the light sandy soils of Coogee and Spearwood, crops of up to 20 tons per acre are grown every year, while, relying on the natural rainfall, profitable crops are grown in the South-West from Albany to Geraldton in various classes of soil. In the peaty swamps at Osborne Park heavy crops are obtained, while in the potato-growing areas around Capel, Burekup, Benger and Brunswick small plots have yielded excellently. Messrs. Higgins Bros., the well-known onion growers of Capel, during the 1919 season harvested the phenomenal yield of 43 tons from 1½ acres. Mr. F. Simper, at Beaconsfield, has just finished harvesting a crop which yielded 28 tons per acre. This remarkable crop was grown in a very light sandy soil thoroughly enriched with artificial manures and decayed vegetable matter. Yields like these give the onion grower a goal at which to aim, and undoubtedly the area at present planted can be greatly enlarged with profit both to the grower and the State.

Preparation of Seed-Bed.—The method generally adopted in Western Australia is to sow the seed in a well prepared seed-bed, and when the plants are from 4 to 6 inches high, to transplant into the field. The preparation of the seed-bed is one of the main essentials of onion culture. Onion seeds are rather small, and hence require a finely pulverised, moist and well compacted seed-bed. The land should be dug as deeply as possible, say, from 9 to 12 inches. If the surface soil overlies a heavy clay, it is inadvisable to bring this to the surface, at least in one operation. A rake can be used to bring the soil into a fine tilth, and the back of the rake drawn rather heavily over it or firmed with the back of a spade will bring it into good condition for the sowing of the onion seeds. Artificial manure can be incorporated with the soil during the digging operation. A good dressing of fertiliser on the top prior to digging, and dug in with a lighter dressing before raking, brings the bed into a satisfactory condition. A suitable manure would be "No. 4" or "E" brand of potato manure, as put up by the local manure works. If obtainable, a dressing of stable manure is desirable, but it must be well rotted, or weeds will be rather troublesome. Make the beds about 6 feet wide, as this width allows hoeing, for the control of weeds, from each side, and does away with the necessity for treading on the bed during weeding operations. Seed should be sown in drills rather than broadcast, as this allows the working of a small hoe in between the plants. A good plan is to make a rake-like structure, with picket-shaped "tynes" spaced about 6 inches apart, which, when drawn lightly through the soil, leaves six or eight small channels ready for the sowing of the seed. Onion seed is comparatively slow germinating, and it is not advisable to plant deeply: if the land is sufficiently moist, the lighter the covering of soil the better the germination.

Selection of Seed.—It is most essential to obtain fresh, reliable seed true to name. Onion seed loses its vitality very quickly, and none older than last season's crop should be procured. Many experienced growers invariably save their own seed, as by selection and judicious cultivation through a series of years it is possible to raise the standard of excellence. I have often heard it said that we cannot grow onions to compare with those grown in the Eastern States, but I have seen some locally grown that compare very favourably with the imported article. I am convinced that if growers would be more careful in the selection of bulbs planted for seed we should soon have a much higher quality onion. Many growers, saving bulbs for planting in order to obtain seed, pick out nice even-shaped and not too large onions. This is quite right, but too little attention is paid to the texture of the skin. Of, perhaps, six onions, similar in size and shape, four may be fairly loose skinned, and the other two may have a large number of very fine, tough skins, closely packed. This, in my opinion, is the type of onion which is desirable to plant for the production of seed. The practice of propagating from the best is sound in all instances of vegetable culture. It is the fine, toughly packed skinned onion which is the best keeper, and I am sure if growers will work along these lines they should have no cause to complain of either the quality or quantity of their crop.

The bulbs saved should be planted out in rows about 3 feet apart. It is advisable to place a stake to each bulb to secure the seed-heads from being blown and knocked about and probably broken by the wind. If the season is favourable—that is, warm and dry—a fair amount of well-ripened seed should be obtained.

Promptness in harvesting is essential, for, if delayed too long, the seed receptacles open, and part of the seed will be lost in handling. When the tops have turned yellow, remove them with about 6 inches of stem and place them in strong paper bags and hang them up in a well-ventilated place to dry. Frequent turning will hasten the drying process, and most of the seed will drop out in the operation. Any seed remaining can be beaten out with a flail or stick; and in the case of a small quantity, rubbing between the hands will satisfactorily extract the seed. It can be cleaned by winnowing. The seed should be stored in a well-ventilated place, free from excessive moisture.

In other cases it may be possible to secure the seed from a neighbouring grower whose stock is known to be good and suited to the district. Where this is not convenient or possible the seed can be obtained from a reliable seedsman. Mixed sorts should be avoided in order that one part of the crop will not ripen before the remainder.

(In the next issue of the Journal further phases of onion culture will be dealt with.)

THE INDUSTRIAL ASPECTS OF ANGORA RABBIT WOOL FARMING.

C. J. CRAIG.

At the time of writing the Angora is the most valuable rabbit in the world. Developed in France for its wool clip, it has, since the war, been greatly improved by the clever breeders of France and Great Britain, until to-day its wool yield exceeds in value that of an average sheep, which costs ten times as much to maintain.

WOOL YIELDS OF THE IMPROVED ANGORA.

The annual wool clip of a good Angora rabbit is worth £1 per year.

One may put the average annual wool yield of a properly bred and fed Angora rabbit at 10 ounces per annum. The British spinners who deal with this valuable fibre are to-day paying 36s. per pound.

WHERE DO WE SELL OUR WOOL?

One is nervous, especially in far-away Australia and New Zealand, over the finding of a market. Do we have to send our little boxfuls or bales to the local auction sales, where the thousands of tons of sheep's wool are annually auctioned? Or must we perform that intricate operation known as exporting? Well, all our qualms can depart. A whole hundredweight of Angora wool can be packed in a small case or bale and consigned at ordinary space rates direct to the British mills. As such a consignment would be worth about £200, it is apparent that the cost and trouble of marketing are insignificant.

The principal (or only) British buyers of Angora rabbit wool to-day are The Derwent Mills, Ltd., Matlock, Derbyshire, and it will be quite a simple matter to send them the New Zealand and Australian production.

The Industrial Rabbit Club of New Zealand, which will probably extend to Australia, will organise a system to collect and market the wool of its members, and do many other things to help the industry.

WHAT IS THE RABBIT CLIMATE?

In France the cold regions are appreciated as tending to denseness of wool. Yet housing is designed to protect from cold. In Britain, where there is no law against indiscriminate farming of rabbits in the open, the Angoras are comfortably housed. Where open-air housing is practised, the discomfort of working in the rain is recognised. The French rabbits have a long, loose fleece; the British a more dense fleece. All the evidence seems to suggest that the breeder is more potent than climate. Fleece weight can be bred in any reasonable climate, and the long dry spells of Australia, coupled with the productiveness in fodder cropping of both Australia and New Zealand, are assets of great importance. As we increase the density and weight of the fleece, we must shear oftener for the rabbit's comfort. Virtue, it seems, has its price.

USES OF ANGORA RABBIT WOOL.

The extraordinary fineness and softness of Angora rabbit wool defy imitation from other sources. Underwear is its principal destination. But men's felt hats of high quality and men's unders also call for increasing

quantities. A union of wool and silk is in great request, and milliners' flowers, dress goods, pads, and ladies' stockings may yet absorb a great tonnage. New uses are continually being added to the list, and old uses extended. Wherever warmth, lightness and softness of touch are desired, there the Angora rabbit fleece is indispensable. The spun yarn of Angora rabbit wool is retailed at about 4/- per ounce, or about £3 per pound. It is washable.

THE LAW ON RABBIT KEEPING.

The law in Australia and New Zealand, up to April, 1928, has prohibited the importation and farming of rabbits. This has deprived the local breeders of the magnificent strains developed in Britain, and throws them back upon the local strains, giving only about one-third of their wool-yield. Unless the law be revoked, or adequate importations be permitted by Order-in-Council, the local breeders will experience years of disheartening struggle to develop a profitable strain. Now, however, New Zealand admits them, and the N.S.W. law has been relaxed.

ANGORAS CANNOT CREATE A RABBIT PEST.

The idea that the industry would increase the wild rabbit pest is ridiculous. There are five sufficient reasons against such a result, in addition to the fact that Angora rabbits have been freely kept as pets for many years without being a nuisance.

(1) The improved Angora rabbit (worth at least £1) is too valuable to be set loose.

(2) It is too tame and too slow to run away from danger.

(3) It is white, and therefore, doomed, immediately it encounters a boy, a dog, a gunman, or a hawk.

(4) With its long, ungainly wool to clog with dirt, this helpless manufactured creature is quite unfitted to the dirty conditions of the burrows.

(5) If it did interbreed with the wild rabbit, the resultant cross would not be fitted to withstand rough conditions, and would therefore be easily controlled.

SWEETBRIAR.

(*Rosa rubiginosa*, Linn.)

C. A. GARDNER,
Government Botanist.

This well-known European plant has been established in Western Australia for many years, and since it is of ornamental value and used for stocks for cultivated roses there is little doubt that its introduction was intentional. It is, however, not a common naturalised plant, and is perhaps most prolific around Bridgetown where it enhances the beauty of the roadsides in the red loamy soil, its flowers making these places reminiscent of British hedgerows in the early summer, the scarlet fruits following in January and February.

Sweetbriar is a proclaimed weed in Queensland, New South Wales and Victoria, and it is also included in the Commonwealth List. The plant also occurs in South Australia and New Zealand, and doubtless also in Tasmania. It is a gazetted noxious weed for the State of Western Australia. In this State, however, it is only in the lower south-west that the

Sweebriar Rose (*Rosa rubiginosa*, Linn.).

plant may be expected to be troublesome. At Bridgetown it has not spread to any appreciable extent in twenty years. It is not expected that it will prove of any consequence to the north of Bridgetown. On the other hand, the plant may become troublesome in the Karri country where a higher rainfall is experienced. In localities such as the Frankland River district and Augusta, Sweetbriar may, if established, demand prompt remedial measures, but at present the plant where established has proved of no consequence from an economic standpoint.

Eradication is best effected by pulling out the plants when the soil is moist. Frequent cutting down, however, should in time weaken the plant and result in death.

Description of Plant.

A shrub of 10-15 feet with several more or less erect stems, spreading by means of suckers. Stems and branches armed with stout hooked prickles. Leaves deciduous, consisting of five to seven leaflets, ovate to lanceolate in outline, serrate, the teeth again toothed, glandular-hairy underneath with rust-coloured hairs, which upon bruising emit the fragance for which the plant is noted. Flowers pink, one to three together, on stalks which are beset with prickles or glandular hairs. Sepals pinnately lobed and glandular-hairy. Fruits scarlet when ripe, usually obovoid, but varying from ovoid to oblong. Flowering period October to December. Indigenous to Europe.

For further particulars see plate.

BEE DISEASES.

PREVENTION AND CURE.

H. WILLOUGHBY LANCE,
Apiculturist.

Firstly let us ascertain the principal diseases that are known to exist, and their symptoms, then deal with general preventative hygiene, and lastly how to treat those diseases which are prevalent in Western Australia.

The disease, which has caused the greatest damage and loss to the industry of recent years, is probably that originally known as "Isle of Wight" disease, and which, after many years of study, is now found to be two separate diseases. The first to be discovered was named "Nosema," and the last, which was the real cause of all the destruction, named "Acarine."

"Isle of Wight" Disease was first noticed in this small island on the south of England in 1904, and shortly afterwards appeared on the mainland and then spread very rapidly, wiping out whole apiaries.

After some years of research, it was discovered that most of the dead bees had a protogan mite in the alimentary canal, and this was put down as the cause and named Nosema apis. Further study, however, revealed that this was not the cause of the trouble. The cause was discovered in 1921 by Dr. Rennie to be a mite of the Tarsonemus family, and was named Woodi. The disease itself was named "Acarine." Instead of Isle of Wight disease, therefore, we now have Nosema Disease and Acarine Disease.

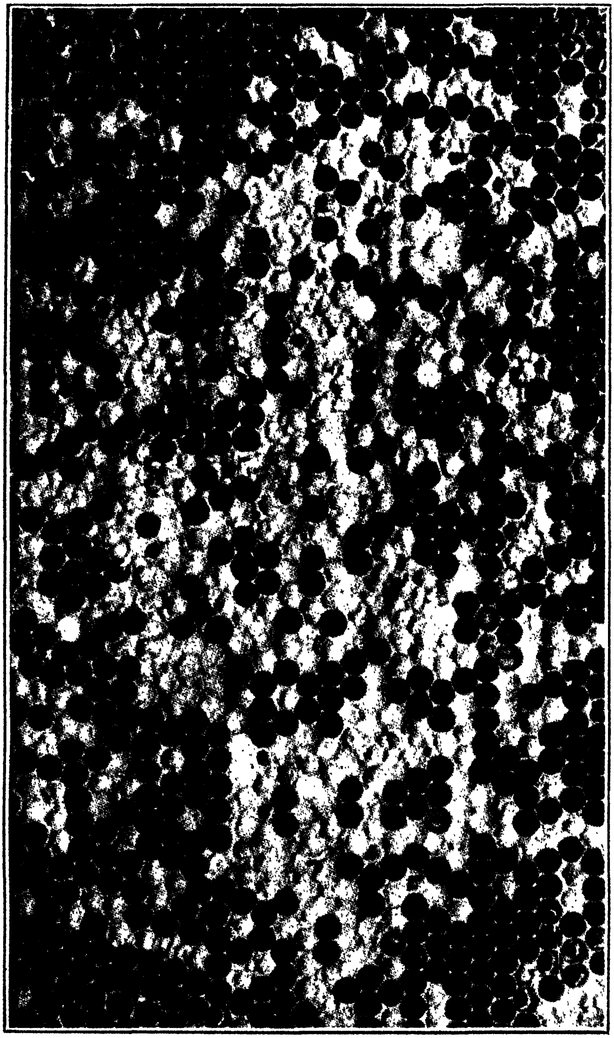
Nosema Disease is known to exist in Great Britain and most South European countries, America and New Zealand. So far, however, it has not been reported in Australia.

It is insidious, and often is spread through the apiary before the Bee-keeper is aware of its presence. The water supply of the apiary is considered to be the chief means of infection.

It usually appears in the spring, the colony dwindling down when there is plenty of brood, and often crawling bees, unable to fly, are noticed. It is, therefore, sometimes mistaken for paralysis. Microscopical examination is the only sure means of detection.

Acarine Disease. The most serious of those affecting Adult Bees. It is found in the British Isles, Switzerland, Germany and parts of France. The causation agent is Tarsonemus Woodi, which invades the respiratory organs of the bee and breeds there. The disease is spread by the contact of healthy bees with those suffering from the disease; the parasites when over-crowded in the sick bee, migrate and seek new living and breeding grounds. Crawling of the bees in large numbers, nearly always away from the hive, with wings in a peculiar position as though dislocated, or with efforts to fly, is the most noticeable symptom. The bees often clustering at the entrance to the hive with the noticeable peculiar position of wings before crawling away. Dysentry and enlargement of the abdomen are also symptoms.

Foul Brood is now divided into two diseases named European and American. The original type was first observed in Europe and it was not for many years that a variety was observed in America and found to be quite distinct.



American Foul Brood (Bacillus larvae) in an advanced stage. Note the patchiness of the brood and the sunken cappings. The few white spots and raised cappings are healthy brood.

European Foul Brood.—Sometimes called Black Brood in America. Although this may appear at any time, it is usually more prevalent in the Spring when the colonies are least prosperous.

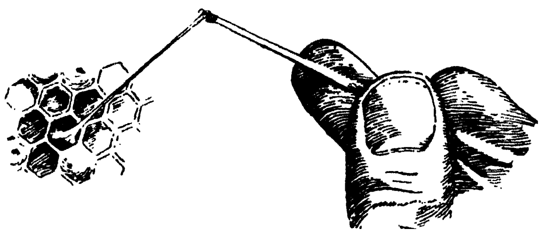
The causative agent is Bacillus pluton, which attacks the brood in the larval stage. It usually proves fatal before the cells are capped over, but in

advanced cases, some dead brood may be found in capped cells. There are sometimes secondary agents associated with the disease, B. alvei and S. apis, which cause a variation in the decomposition of the larvae and cause it to be mistaken for American.

The dead larvae first of all appears as a rotten mass, at first slightly yellow, then a dark brown and finally black in the cell, and afterwards dries to a semi-plastic mass and later to a scale slightly adherent to the cell wall, which can be removed by the bees.

There is sometimes a slightly sour or fermenting odour. If a match or chip of wood is inserted into the cell, the rotten mass may adhere to it, but will not pull out any length as does American Foul Brood.

American Foul Brood is undoubtedly the worst disease that the Australian and New Zealand Beekeeper has to combat, as it is more insidious and may lie dormant in old combs and honey for several years. It does not appear that any country, where commercial beekeeping has been in existence for any length of time, is free from it.



One test for American Foul Brood.
Note how the diseased larvae draws out.
(*Photo. from U.S.A. Dept. of Agric., Bulletin No. 442.*)

In some parts of America, and New Zealand, it has caused the loss of thousands of pounds worth of stock. In spite of much better inspection in New Zealand than in Australia, it has got such a hold that, under the Apiaries Act, no one is allowed to move any bees whatever, whether they are in a diseased district or not, without notice to the Apicultural Department. American Foul Brood may frequently be detected by the smell coming from the entrance to the hive, or upon lifting the cover, the odour being like that of an old glue pot being warmed up on the stove.

It is caused by Bacillus larvae, the brood usually dying after capping has taken place, the cappings having a dark brown colour, with a shrunken instead of raised appearance and many of them have pin holes in the centre. American Foul Brood appears at any time that breeding is taking place, but European nearly always in the Spring. If a splinter of wood is thrust into the cell and withdrawn, a sticky mass of a brown or coffee and milk colour, will adhere to it and upon withdrawing same, will string out to half an inch or more and then break and fly back like elastic.

After a while these rotten masses dry up into a dark brown tongue like scale, adhering firmly to the bottom edge of the cell. These contain the spores of future generations, being patchy and scattered all over the comb.

This is the most dangerous condition, as it is not easily detected and may lie dormant for several years, until suitable conditions arise for germination.

Spores kept in a laboratory for over 3 years have been cultivated and produced the active form of the disease. The best way to detect these spores is to hold the comb at an angle so that the light falls on the lower cell walls, when the tongue-like mass will be seen at the edge.

Sac-Brood, Sour-Brood, and "Pickled Brood" according to different writers, appears to be the same disease. The chitine or skin of the dead larvae does not disappear as in Foul Brood, but toughens so that the remains may easily be removed from the cell. The contents are watery and granular in appearance with a strong acid smell resembling vinegar. The colour is usually yellow, darkening to brown, but it is sometimes of a greyish colour. In drying, the surface becomes wrinkled, finally nothing remains but a "scale" which does not adhere to the cell wall. Streptoccus Apis is considered to be the cause of Sour Brood.

Chilled Brood is not really a disease, but is caused by snaps of cold weather after good breeding weather with Honey and Pollen coming in, causing Queen to lay rapidly. Then during the cold weather, there not being sufficient bees to cover the brood, they die of cold, or it may be caused by bee-keepers opening and exposing the brood on a cold day.

The appearance of the dead larvae is usually of a greyish nature, not yellow or brown and the skin is distinguishable, not rotten like foul brood.

Dysentry is a disease of the adult bees. The usual signs being that the bees discharge their excrement over their combs and hive, just wherever they happen to be, the faeces being dark and muddy in appearance with a peculiar offensive smell, the bees are weak, slow in movement, and decrease unusually fast.

It is caused by unsuitable food, poor quality, watery, or fermented honey or syrup made from impure sugar. The disease usually appears after the bees have been confined to the hive for a long period owing to inclement weather.

Paralysis.—In this disease the bees are noticed to have swollen abdomens, and are seen crawling from the hive shaking and trembling, many becoming black and shiny. Very often healthy bees may be seen dragging the diseased ones away from the hive and in a little time the hive becomes very weak.

There is no definite information as to the cause of this disease, but T. W. Cowen in the British Beekeeper's Guide Book, refers to an undetermined disease, which apparently corresponds with what we know as paralysis. He states that it is caused by a micro-organism termed Mucor melittaphthorus. In 1881 Drs. Bernernan and Hubner found spores of Mucor micedo among the fat corpuscles of the abdomen, in some cases so thickly as to prevent the circulation of air for distension of the air sac, thus making the bees unable to fly. Spores were also found in the lower portion of the abdomen causing abdominal distension.

Bee paralysis seems to be more virulent in hot rather than cold climates, also some strains of bees are more immune to it than others. F. W. Buehme considers that he has it well under control by developing and propagating a strain of vigorons leather Italians. He does not find the yellow strains so resistant. Paralysis is not transmitted by brood or combs but by dead or sick bees.

Dr. C. E. Burnside, of the Bee Culture Laboratory of the United States of America, has recently been studying sick and dying bees, showing symptoms of paralysis, and has found in the blood of these bees a heretofore unrecognised organism Bacillus apisticus, which he considers to be the cause of the trouble.

He found the disease to be worse in damp places, and suggests well-drained apiary sites exposed to direct sunlight as being helpful to prevent the trouble.

Spring Dwindling is not a disease but is a trouble that has caused a lot of discussion at times. The symptoms are that in the Spring, certain hives although they appear to be healthy with a good Queen, do not build up but dwindle in strength and frequently a large number of dead bees are seen lying about.

The cause, in some cases, is that the colonies have wintered with mostly old bees and that very little breeding has taken place during the Winter. Then a spell of fine weather comes on with honey and pollen coming in and the old bees working their hardest die off before sufficient young brood has been hatched and are fit to take their places.

May Disease, is a spring disease known in Europe and America, and in some cases may be the cause of so-called Spring dwindling. This, however, can only be ascertained by scientific investigation, for which, unfortunately, there are practically no facilities in this country.

Dr. L. Lardinois of Belgium attributes the disease to a ferment, saccharomyces (mykes, mushroom) which infest the body of the bee; this ferment is also found in honey and pollen. The usual symptoms are that the adult bee loses its hair and cannot discharge its faeces. During the summer the colony does not show much infection, but in the winter when breeding is restricted it becomes a menace to the colony. The Queen is not immune and may easily cause a colony to become queenless in early Spring.

Cold weather, fermented or watery honey, badly ventilated, or too large a hive may bring about this disease.

Bee-Louse.—Probably most Bee-keepers are not aware of the existence of this parasite, as it is seldom referred to in Australian publications. The Bee-louse, Braula coeca, attaches itself to the head of the bee, feeding on honey, which by various irritating methods, it induces the bee to exude from its mouth. It is not a serious menace, but in serious cases of infestation of weak colonies, weakens the stamina of the bees, making them more liable to the attacks of disease.

Having briefly described the principal diseases, I will now deal with the most important subject.

PREVENTION.

Disease is caused by parasitic organisms such as living parasites, bacteria, fungi and moulds, when the complaints are infectious, or by unnatural conditions such as excessive cold or moisture, bad ventilation, unsuitable food, these being non-infectious.

Bees need to be studied and cared for, if Bee-keepers would make a success of their calling or hobby.

Firstly, good weather-proof hives of approved design.

Secondly, strong colonies headed by a good Queen preferably Italian, as this race resist disease much better than the Black German.

Thirdly, cleanliness.

Fourthly, knowledge of the normal healthy symptoms of bee-life and being on the alert at the first appearance of anything abnormal.

The question of Hives is too lengthy to be dealt with here. I would, however, warn Bee-keepers against using second-hand hives without ascertaining that they are not second-hand because the bees have died of disease. But under any circumstances, they should be thoroughly disinfected. If purchasing from an unknown person or district, he should communicate with the Agricultural Department as it might save him much trouble and loss.

Dealing with Cleanliness. All hives should be cleaned once a year. A number of hives should be prepared during the Winter and when the bee-keeper makes his Spring examination the colonies should be transferred to these. The old hives should then be thoroughly cleansed and scrubbed with a disinfectant. Some use a solution of Calverts No. 5 Carbolic but the disinfectant largely used by bee-keepers in Great Britain is Izal. The strength being 1 part Izal to 300 of water. Izal is a non-poisonous antiseptic, not objected to by the bees.

Floor boards should not be fixed to the body of the hive as they are so much more difficult to clean properly.

If the floor board is loose, it is an easy matter to cleanse at any time in addition to the annual cleaning, by lifting the body on one side and scraping away any refuse.

In cases where the Apiarist supplies water for his bees, it is advisable to add a little Izal to this, especially if he suspects that there is any disease in the neighbourhood. The Izal will act as an Antiseptic, the solution being 1 in 300. If feeding has to be resorted to, 1 oz. of Izal to 80 lbs. of Sugar and 6 gallons of water is recommended as a good antiseptic.

Fourthly the Bee-keeper should make himself familiar with the early symptoms of the various diseases, so that he may take prompt measures to deal with same. If in doubt, he should communicate at once with the Agricultural Department.

There is one cause of infection over which the Apiarist unfortunately, has no control. That is from empty honey containers thrown out on the rubbish heap, which are cleaned up by the bees and disease often carried into the hives. In several cases this appears to be the only reasonable cause for the breaking out of disease in certain districts. There is only one thing the Bee-keeper can do, that is keep his eye open for both the old containers and the appearance of disease.

One of the most important things next to cleanliness is to keep all colonies strong in bees, any weak ones in the Autumn or Spring should be united. Those getting weak through old or failing Queen should be re-queened if there is sufficient honey and pollen coming in.

I will now deal with the Cure of Disease after it has been discovered.

As Nosema and Acarine Diseases are not at present troubling the Australian Bee-keeper, we need not take up time describing methods of dealing with same.

European Foul Brood is not so serious as the American type although the spores of Bacillus pluton like that of Bacillus larvae are highly resistant to the action of all antiseptics, and the use of any for the purpose of cure is useless. It may, however, be given in food for the bees and has a good effect in preventing the putrifactive action of the secondary organisms, thus enabling the bees to more easily remove the dead brood.

The Method of Treatment is as follows.—Remove the combs of food stores and clean empty cells together with the bees, and place in a clean hive, sterilised by Izal 1 in 300 placed on the position occupied by the old hive. The old Queen should be destroyed, and the colony re queened with a good Italian one from a strong stock, and stimulated by feeding for brood production.

Combs containing diseased brood should be destroyed by fire, but if there are a large number only slightly diseased, these may be sterilised by Formalin solution.

American Foul Brood.—Of all the diseases that we have in Australia this is the most difficult to eradicate. The spores of Bacillus larvae are very resistant to antiseptics and also to heat and may lie dormant for years.

When the larvae dies, the remains dry down to a brown tongue-like scale that adheres firmly to the lower wall of the cell. This scale contains millions of spores, which are like the seeds of a plant and only require suitable conditions for them to germinate and start the disease afresh. It has been proved beyond doubt that these spores are carried in honey and pollen. Experiments have been made by feeding healthy bees with honey from a diseased colony, and shortly afterwards the disease appeared in the brood of the healthy colony.

The method of treatment is as follows:—Prepare a new hive disinfected with Izal, and fitted with frames of foundation, no old combs must be used nor any food or brood. Towards evening remove diseased hive on one side, and place new hive on the old stand Place a large sheet of newspaper in front of new hive right up to the entrance. Next shake all the bees from the old combs on to the paper in front of hive. The reason for the paper is that in shaking some honey may fall out of the old comb. As each comb is clear of bees it should be placed in a box inaccessible to bees. The paper must be destroyed by fire immediately the operation is complete.

As there are no combs in the new hive, the bees will consume any honey they carry with them for making wax for the new combs, therefore no food must be given and the bees left undisturbed for four days. It is also advisable to place a guard over the entrance to prevent the queen coming out and the bees absconding.

The infected hive to be immediately removed to a place inaccessible to bees. All frames and combs containing any diseased brood or dried scale must immediately be destroyed by fire.

Any combs containing honey alone may have the honey removed therefrom. Care must be taken that no bees have access to this honey or any apparatus that has contained same nor must the honey be put on the market.

These combs must then be sterilized by being completely immersed in a solution of 20 parts of Formalin to 50 parts of water for 48 hours. On removing the combs from the solution they should be washed with water by passing to and fro and backwards and forwards under a free flowing tap to remove all traces of formalin.

In most cases, it will not pay the bee-keeper to attempt this sterilising treatment, but to burn the combs of honey with the diseased ones.

Any combs that cannot be so treated must be destroyed by fire or melted down in boiling water for 30 minutes and any refuse therefrom destroyed by fire.

All parts of the hive and any apparatus that has come in contact with same, should be thoroughly scorched with a painter's blow lamp or immersed in boiling water for 30 minutes.

Tools and hands may be cleansed in a 50 per cent. Formalin solution.

The colony should be carefully watched for several weeks as occasionally a stray bee may carry the germs of the disease with it. In this case a second shaking will effect a cure. The bees may now be stimulated by feeding, preferably with syrup or honey medicated with Izal 1 oz. to 9-10 gallons.

Sacbrood.—There is no special treatment for this disease, as it usually disappears by itself, but in severe cases it is advisable to re-queen.

Chilled Brood.—Prevention by careful management is the only way of dealing with this.

Dysentry.—Prevention is again better than cure. Protect against extremes of cold in Winter. See that the colony has good food.

Paralysis.—In most cases, destroying the Queen of the infected colony and introducing a new one effects a cure in a few weeks. If there are any mouldy combs, remove same. Stimulate with Izal Syrup and disinfect with Izal 1-300.

Spring Dwindling and May Disease.—See that the colonies have plenty of good honey and pollen, and that the hives are weather proof, ventilated and suitable to the size of the colonies. If colonies become very weak, they should be united, and in many cases re-queened.

Bee Louse.—A few pieces of Naptha placed on the floor at the back of the hive, causes the louse to drop off.

Finally—Good clean hives. A strong disease-resistant strain of bees. A careful study of the natural healthy life of the bee is the best insurance any bee-keeper can have against disease.

STANDARD WHEAT VARIETIES.

AND WHEN TO PLANT.

I. THOMAS,
Superintendent of Wheat Farms.

The disastrous results which were experienced by many farmers last year have caused them to realise the importance of fallowing. Important though this factor is, it must be remembered that success does not depend on this entirely. The necessity for liberal dressings of Superphosphate is also becoming more generally recognised; but the planting of suitable varieties at the correct time does not receive the attention that it warrants.

This may be due to ignorance on the part of many, and for the benefit and guidance of these, a planting table has been prepared together with details relative to characteristics of the recommended standard varieties.

Although the table refers only to these varieties, it may be applied to all varieties having similar maturity.

LATE MATURING VARIETIES.

Yandilla King.—A late variety with stiff and upstanding straw; a profuse stooler and good yielder. It is the best variety of the late class, and because of its excellent record on varied conditions of soil and climate it is considered the standard late variety. It is resistant to Flag Smut and Rust, escaping, but susceptible, to Bunt.

Baroota Wonder Early.—A standard hay variety of the older settled districts of the State. Two distinct types have been obtained from the old strain of this variety, one of which is much earlier than the other, and this has been retained. This matures about the same time as "Nabawa," and is an excellent yielder of prime quality hay. When sown for hay, however, it is advisable to treat it as a late variety and plant it early It is a fair to moderate yielder of grain, liable to Rust and very susceptible to Bunt, but resistant to Flag Smut.

MIDSEASON MATURING VARIETIES.

Nabawa.—This variety has been produced by the W.A. Department of Agriculture with the object of replacing "Federation" in those districts where the liability to rust attacks renders the latter an undesirable variety. It has to its credit performances of great merit in both heavy and light land, and it has been found a prolific yielder in every district of the Wheat Belt; it is, therefore, the standard variety of the midseason class. It is susceptible to Bunt, but resistant to Flag Smut.

Dindiloa.—A variety of about the same maturity as "Nabawa." Of good straw, and probably more suitable for hay than "Nabawa." It is a consistent yielder but rather difficult to strip: an excellent milling variety; very resistant to Bunt.

EARLY MATURING VARIETIES.

Gluyas Early.—The standard variety of the "early" class. It has a great capacity for consistently yielding well under a low rainfall, but has a tendency to lodge especially in heavy weather. It is very susceptible to Bunt and Flag Smut, but is resistant to Rust.

S.H.J.—This is a variety produced at the Chapman Experiment Farm, and called after the late Samuel Henry Jupp, pioneer of that district (Nabawa). It is one of the most promising of the early varieties, and a consistent yielder. Its trials have indicated that it will thrive under the same conditions as "Gluyas Early" and may supplant that variety. It resists Bunt and Flag Smut as well as Rust.

EARLY VARIETIES WITH SPECIAL MILLING QUALITIES.

Comeback.—This is a standard milling variety of the Premier milling class. It is not particularly prolific, but suitable for both hay and grain, producing a very good quality hay. It is very susceptible to Bunt, but resistant to Flag Smut and Rust.

Carrabin.—A variety belonging to the same class as "Comeback." It yields well and consistently. It has stout straw and stands up well. Its defect is that it is rather difficult to thrash and on this account has not found as much favour with farmers as otherwise it would do. It is susceptible to Bunt, but resistant to Flag Smut and Rust.

VERY EARLY MATURING VARIETIES.

Noongar.—This is one of the latest productions of the Department of Agriculture and is probably the earliest variety in general cultivation in this State. In the trials at Kalgoorlie it has proved extremely drought resistant, and is now under trial in the extreme Eastern Belt, for which it is considered to be suitable for planting the latter part of May. It is susceptible to Bunt, but resistant to Flag Smut.

Geeralying.—This is a variety rather earlier than "Gluyas Early," but has proved particularly prolific in the extreme Northern part of this State, more so when sown towards the end of the season, *i.e.*, about the third week in May. It is rather tall in the stalk and therefore useful for hay and of great promise for the districts where early maturity is advisable. It is susceptible to Bunt, but resistant to Flag Smut and Rust.

STANDARD VARIETIES FOR THE DIFFERENT ZONES AND THEIR PLANTING DATES.

Varieties.	Early Zone.	Midseason Zone.	Late Zone.
Late Varieties. Yandilla King Barootа Wonder Early (For Hay)	April 1st to April 21st	April 1st to May 7th	April 1st to May 21st.
Midseason Varieties. Nabawa ... Dindiloa ...	April 21st to May 14th	April 21st to May 21st	May 7th to May 30th.
Early Varieties. Gluyas Early ... S.H.J. ... ... Carrabin ... Comeback ...	May 7th to May 30th	May 14th to May 30th	May 14th to June 21st.
Very Early Varieties. Noongaar ... Geeralying ...	May 21st to May 30th	May 14th to May 30th	May 14th to June 21st.

POTATO GROWING.

THE VALUE OF A CHANGE OF SEED.

W. E. COLLINS,
Potato Inspector.

When a grower has found that it pays him to obtain seed of a certain variety from a certain source, he should endeavour by experiment and calculation to learn whether it will pay him to change his seed every year, every two years, or every three years.

It is very evident, and is known from experience by many growers, that profitable yields cannot be obtained from the continued use of home grown seed.

The decline of vigour is often due to want of care in the selection of tubers for seed, and to the method of handling same between digging and planting time, or, it may be attributed to the persistent planting of unsprouted and unrested seed.

In certain South-West districts, it is common practice to do this, the cut sets lying dormant after planting in the cold wet soil for the lengthy period of 8 to 10 weeks before germinating. This must mitigate largely against high yields and may give a semblance to any one of the virus troubles so prevalent in this area, whilst not being actual.

This assumption being based on the fact, that many times identical seed has been planted at a later date with a consequent vigorous and healthy growth, and with far heavier yields.

When one considers the possible chemical changes occurring within the "set," the loss of plant food by soil organisms, besides the leaching away of valuable essentials from the fertilisers by the heavy rains, it will appeal to all thoughtful growers the wisdom of planting more forward or "sprouted" seed.

Nevertheless, it has been found that, with every care taken in selection and storing, a variety has ceased to yield a satisfactory crop. This decline suggests the presence of a disease or degeneracy, and in such cases a change of seed is necessary. Too much stress can hardly be laid on the importance of securing new seed from a district known by previous experience to give a good change.

With all crops the proper selection of seed is essential to success, but in the growing of potatoes, it is of primary importance. The origin and treatment of the seed has often a greater influence on productiveness than methods of cultivation, manuring, etc., and neglect to pay proper attention to these points may nullify the care, labour and money expended on cultivation and fertilisers.

Results of experiments with seed, which have clearly shown the advantage of obtaining a change, could be quoted almost indefinitely, and the growing trade in seed potatoes from our Southern Areas, especially those grown under Government supervision, is clear evidence of the importance attached by growers to the effect of a change. Reports from numerous growers, in a number of cases, state that Certified Seed gave double and treble the yield of their home grown seed.

Southern grown seed is, at present, generally accepted as being more productive than that grown in the South-West areas, the difference being ascribed to the care taken, the longer rest period between cropping and to the cooler and more favourable climatic conditions under which they are grown. But Benger Swamp seed should, and will be comparable with the best of the Southern product, since tuber forming and the maturing of crops takes place during the cooler months of Autumn.

Swamp growers have invested largely in Certified Seed, which gave gratifying results in the general crop, and quite a lot of the progeny has been planted this current season. It only remains for those desirous of selling part of their product for seed, to exercise the same care that is taken by our Southern growers.

It is well known that the locality, where seed potatoes are produced, has an important bearing on productiveness and Benger Swamp has not entirely lost the reputation of producing tubers highly desirable for seed purposes.

The method which has been largely adopted for some years by the Southern growers is to select seed size tubers from crops grown in the late winter or early spring, these are placed on shallow racks and stored, tier form, in either well ventilated and well lighted sheds, or under bough covered shelters. From time to time the order of the racks is reversed, so as to ensure an equal amount of light to all the potatoes. This treatment leads to the greening of the seed, and the development of short, sturdy green sprouts, which do not easily break off during planting, instead of the long and thin bleached shoots of those stored in bags in dark sheds, and which are sure to be rubbed off.

Seed, when thus sprouted, gives the grower the opportunity of discarding "rogues," those of weakly growth, and the elimination of any tuber showing signs of disease. It is this care, combined with the close field inspections, given by the officers of the Potato Branch, and the grading carried out at harvesting, that go to the perfecting of the Certified Seed Scheme—making this seed more desirable than that generally retained from ordinary commercial crops.

Records of experiments conducted with sprouted and unsprouted seed are unanimous in one respect—the sprouted seed always matures earlier, and it has been definitely shown that when crops derived from the two types of seed are compared, that produced from sprouted seed is always the greater in yield.

HORTICULTURAL NOTES.

GEO. W. WICKENS,
Superintendent of Horticulture.

SEASONAL WORK FOR APRIL, MAY AND JUNE.

April.

April is the best month for making the general application of fertilisers in deciduous orchards: 6 cwt. of superphosphate, 2 to 3 cwt. of muriate or sulphate of potash per acre, with $1\frac{1}{2}$ bushels of peas sown in April and ploughed under in spring will keep all trees in good heart. Apple trees in particular will need heavily fertilising to enable them to stand the strain of the very heavy crop which has been borne this year.

Where citrus orchards are being treated, use half the super. and half the potash mentioned above, and apply the remainder in spring.

If for any reason, peas cannot be grown satisfactorily, use 2 to 3 cwt. of sulphate of ammonia or nitrate of soda; apply same in spring, whether the orchard to be fertilised is citrus or deciduous.

In orchards where Citrus Brown Rot was experienced last season, citrus trees should be sprayed to a height of four to five feet from the ground, together with the land under, and extending for a foot or more outside the spread of the branches. Use Bordeaux at a strength of 4 lbs. bluestone, 4 lbs. freshly-burned lime to 50 gallons of water; or Burgundy at a strength of 4 lbs. bluestone, 6 lbs. washing soda, 50 gallons of water. The trees should not be sprayed all over or the beneficial fungi which attack lecanium scales will be destroyed, and these pests will increase with great rapidity.

In districts where Fruit Fly exists every care should be taken to collect all second crop deciduous fruits which, owing to having no commercial value, are often allowed to remain on the trees, become infested, and carry on the pest to the orange crop. All fallen fruits should be collected, and those of no value destroyed by boiling.

May.

Pruning will now claim the attention of growers of stone fruits, particularly in the early districts near Perth, where most varieties of apricots, plums and peaches will have shed their foliage. Where varieties of peaches liable to shed their buds ("Briggs," "Hales," "Downing," "Alexander," etc.) are grown, it is advisable to delay pruning until the buds have burst in early spring.

Spray deciduous orchards for the control of San José Scale as soon as the leaves have fallen, using commercial lime sulphur at a strength of one gallon in seven gallons of water, or a reliable brand of spraying oil may be substituted for lime sulphur, using one gallon of oil in 19 gallons of water. To keep San José Scale in check it is necessary to spray twice while the trees are dormant: the first to be applied as early as possible after the leaves have fallen, and the second towards the end of winter in late August. As August is often a very wet month, care should be exercised in making the May spraying a very thorough one.

Where orange and lemon trees in affected orchards were not treated for Brown Rot last month they should be sprayed during the early part of this month, using Bordeaux or Burgundy as advised in April notes. In tests made both by this Department and individual growers it has been shown that one spraying in April or early May is sometimes sufficient to control the disease for the remainder of the season, but should the season prove favourable for the fungus, the trees should receive a further spraying when signs of infection appear. Later sprayings have the effect of spotting the fruit, but it is better to remove spray spots from sound fruits at time of picking than to have the crop destroyed by disease.

With the advent of wet weather, baiting operations for Fruit Fly are largely ineffective, but trapping in orange and lemon groves should be continued throughout the winter months.

June.

Pruning of all deciduous trees should be pushed on with during this month.

Planting may be undertaken wherever the soil is not too wet and sticky.

Young plants, when received from the nursery, should be heeled in carefully so as to prevent the roofs from drying out. To do this effectively the bundles of ten, in which the nurserymen usually tie up the trees, should be opened and each tree placed separately in the soil. If this is done as soon as the trees arrive, no harm will result if the planting has to be postponed for some weeks in the months of June or July.

The notes on planting for this month refer to deciduous trees only. Citrus trees give best results if planted at the latter end of August or early in September.

Any San José Scale infested orchards which have not received the first spraying mentioned in notes for May, should be treated as early as possible this month.

Citrus growers should examine cracked oranges for signs of Fruit Fly, and destroy any found to be infested.

The orange export season commences this month, and this opportunity is taken again to stress the importance of handling the fruit most carefully when gathering, packing and loading. Bruised fruit and fruit with skin abrasions caused by finger nails will develop moulds and arrive in an unsaleable condition, a loss directly to the sender to the extent of the affected fruit, and indirectly and probably a much greater loss in bearing down the price of sound fruit offering on the same market.

THE SUBTERRANEAN CLOVER WEEVIL.

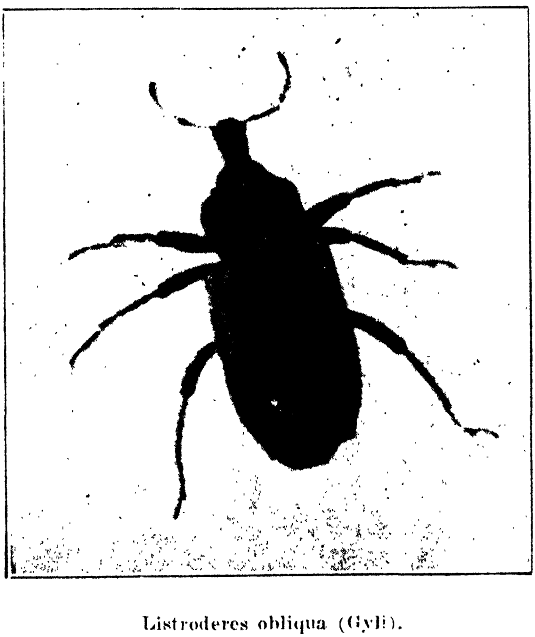
(*Listroderes praemorsa.*)

L. J. NEWMAN,
Entomologist.

Order: *Coleoptera.* Family: *Curculionidae.*

During the past winter and spring complaints were received by this office to the effect that something was seriously destroying the Subterranean Clover (*Trifolium subterraneum*).

The complaints were at once investigated, revealing the causative factor to be the above weevil. In further prosecuting the investigation, it was discovered that similar damage was being done to the crops in several of the South-West areas.



Listroderes obliqua (Gyll).
Dorsal or Back view.

(× 6 *Original.*)

Indirect evidence was also found that the weevil had been at work the previous year, but not seriously. The past season was the first record of it appearing in plague form over considerable areas.

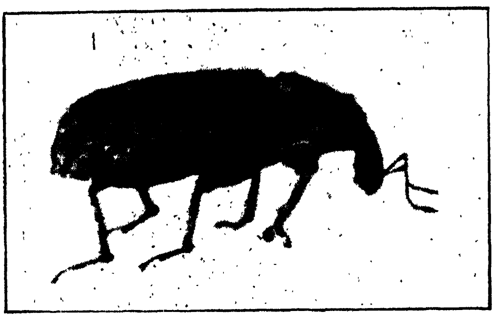
The same insect has been known as a minor pest in the metropolitan districts for many years. Its appearance in the role of a clover pest is a more recent and serious development.

In view of the fact that Subterranean Clover is one of the most important of our field fodder crops, every effort will need to be made to check this insect.

The common Cape Weed (*Cryptostemma calendulaceum*) is also a favoured host plant. Tomatoes, potatoes and other garden crops are sometimes attacked. Subterranean Clover appears, however, to be the favoured one when available.

This destructive beetle belongs to a small group of weevils, which damage plants both in the larval and adult stages of their existence. It is one of the *Curculionidae* and belongs to the Genus, *Listroderes*, and is specifically named *Listroderes praemorsa.*

Another weevil belonging to the Genus *Listroderes,* and known as *Listroderes obliqua* (*nocira Lea*) is also found in the South-West. So far this closely related beetle has not become a clover pest, confining its attacks to carrots, potatoes and other garden crops.



Listroderes obliqua (Gyll).
Side view.

(× 6 *Original.*)

DESCRIPTION OF *LISTRODERES PRAEMORSA.*

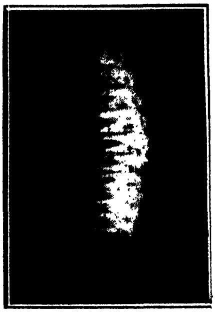
The Larva.—When first hatched is very small and of a light creamy colour, with black head. As it grows and moults, the body becomes a translucent green colour, due to the green food contents of the digestive organs. The larva is of a more slender form than the usual weevil grub. The body is slightly under ½in. long, somewhat tapered at each end and wrinkled. The head and thoracic plate are yellowish-brown, with four ocelli or simple eyes. A series of dotted lines on the head form a fairly regular pattern about the Y-shaped suture on the vertex on the head. The thoracic plate is inconspicuously divided in the centre, paler than head and darker towards the extremities.

Like all weevils, these grubs are legless, but the ventral side of each segment, is provided with a transverse row of four tubercles, which enable the larva to hang on to its food and also move about readily from plant to plant.

Further, just below the breathing spiracles, on either side are two longitudinal rows of tubercles or sucker feet, which give attachment to the

plant. These tubercles are not armed with short spines, as in the case of its near relative *Listroderes obliqua.*

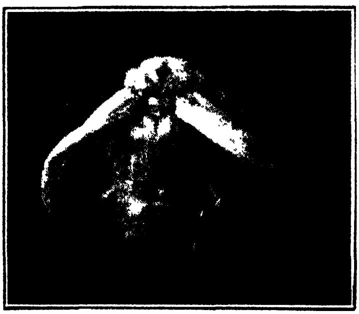
The grubs live gregariously, that is, they move about in armies taking the Subterranean Clover on a face. The feeding is mainly done at night, but advantage is taken of dull cloudy days to feed. The larva lives for a period of 12 to 14 weeks.



Larva or Grub,
Listroderes praemorsa.
(× 4 *Original.*)

When fully grown it burrows into the soil to a depth of 1½ to 2 inches, forms an earthen cell, and therein pupates. This takes place in late August to end of September.

Pupa.—This is the resting stage when the grub is transformed into the adult beetle. It is of a pale greenish-yellow, has a general resemblance



Pupa,
Listroderes praemorsa.
(× 5 *Original.*)

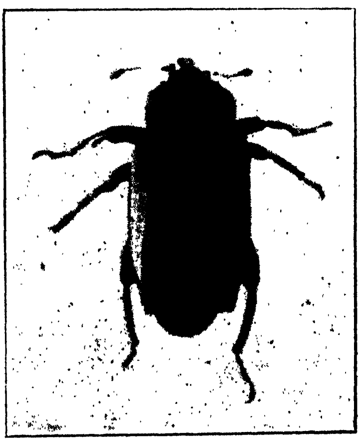
to the adult, and is slightly shorter than the larva. Legs, antennae and wing pads can all be observed. The short, broad rostrum or beak is seen to be folded backwards, along the ventral or under surface of the body.

Between the eyes are three pairs of stiff brown bristles, arranged in an arc. Just below these, on the rostrum, are six smaller bristles. Further down, nearly to the jaws of the rostrum, are two more larger ones. Similar spines exist on the thorax and abdomen.

Each of the eight visible abdominal segments has a transverse dorsal row of spines. When disturbed the pupa will rapidly rotate the abdomen, turning the whole body round and round.

As the time approaches for the adult to emerge, the eyes of the pupa become prominent, the beak, legs and antennae become reddish brown. The period occupied by this stage, under cage incubation, was 17 to 21 days.

The Imago or Adult.—On emerging from the pupa the adult is quite soft and of a pale rusty-brownish colour, and one-third of an inch long. The beetle does not issue at once from its earthen cell, but remains quiet for two or three days. During this time the chitinous wing covers of the



Imago or Adult,
Listroderes praemorsa.
Dorsal or Back view.

(× 6 Original.)

body harden up and generally assume a light fawn or brownish colour, very similar to the colour of the soil. When ready the weevil cuts a hole in the cell, pushes its way to the surface of the ground, and is then ready for its adult duties.

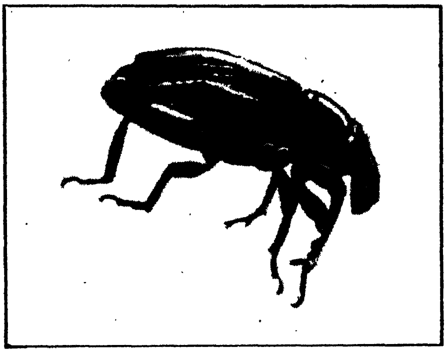
It is a typical weevil, with short stout beak, bearing the usual elbowed antennae clubbed at the tip. The chewing jaws are situated at the tip of the snout or beak. The general colour after exposure to the surface light is brown, with the sides of the wing covers light fawn. The elytra are deeply striated, giving a corrugated appearance when looked at with a lens. There is a line of white scales running longitudinally on the thorax.

Two oblique patches, consisting of light-grey scales forming somewhat of an inconspicuous V-shaped mark are to be seen at the posterior ends of the elytra.

Just below these marks are a pair of processes giving a pointed or spined appearance.

The legs and under side of the body are dark red. When handled it feigns death.

Efforts have been made to induce flight, but although flight wings are present, this act has not yet been observed. In the field the beetles make no effort to fly from place to place, but will crawl rapidly over the ground. It may be that the flight wings are only used during the breeding season. The adult beetles live for several months. They make their main appearance in October, November, some early ones appearing in September. The clover and grasses are then beginning to dry up. The weevils have no incentive to lay their eggs when the natural food is drying up. They appear



Imago or Adult Listroderes praemorsa.
Side view.

(× 6 Original.)

to hide away in cracks and crevices in the soil, under logs, stones, loose bark, cracks in fence posts, or any other place that offers suitable shelter. Many beetles die during this carry-over period. Upon the advent of the autumn rains the survivors probably come forth and lay their eggs amongst the young clover seedlings. The life history is peculiar in that it is active during autumn, winter and spring, the adults aestivating or hiding away during the dry summer months. There is only one generation each year, with considerable overlapping of the life stages.

Several points concerning the life history of this weevil have yet to be cleaned up.

Nature of Damage done.—The young grubs upon hatching from the eggs at once begin their attack upon the foliage of their food plant, whether it be Cape Weed, Potato or Subterranean Clover. They feed on the under

side of the leaf. As they grow they become more voracious and consume the Subterranean Clover foliage, both stem and leaf, leaving the ground perfectly free and bare. It is the presence of these barren patches that attract the attention of the farmer, indicating that something is radically wrong.

An examination in the day time might fail to reveal the culprit, as the grubs are hidden away, being in the main nocturnal feeders.

Peculiarly the other clovers and grasses do not appear to be seriously attacked by this weevil.

A characteristic feature noted was the outbreaking of the weevil in small circular patches.

As the young grubs grow they work outwards from the centre forming ever-widening circles. Numbers of these circular patches would form, which eventually coalesced, forming larger areas. Some patches would extend over an acre of ground. The Subterranean Clover so eaten down never made a satisfactory recovery. The loss occasioned by this weevil on a farm would be very serious if allowed to go unchecked. Whether being grown for hay, seed, or as a grazing crop, the economic loss is great.

Combined with the ravages of the Lucerne Flea (*Smynthuris virides*) the Subterranean Clover is seriously threatened as a fodder crop in the South-West. When insects appear in serious numbers over large areas of country, their control by artificial measures is difficult and costly.

Prevention.—In carrying out the investigation of this pest, it was definitely proved that clover lands became what is termed "Clover sick." This is a term which might mean anything. The facts found to bring about these conditions were the accumulation of insect pests, fungoid disease and weeds, the clover becoming more or less overcome.

To prevent this position from arising, it is necessary to fallow the clover paddocks every third or fourth year. This method will also act as a check upon other serious Subterranean clover pests, namely the Lucerne Flea (*Symnthuris viridis*) and the Red Legged Earth Mite (*Penthaleus destructor*).

To obtain the maximum effect from fallowing, it is essential that it be undertaken as soon as it is possible to get on to the land in the spring, certainly not later than mid-September. If left later, many of the grubs will have reached the pupae stage, and consequently, although turned over in the ploughing, many will issue as beetles. By turning in early the larvae are starved, and consequently never reach the beetle stage. The fallow must be kept free of weeds or clovers and worked now and then. Land so treated can be resown to oats and clover the following autumn.

The fallowing will have to be done systematically, the farm being so divided that each year some portion will be turned over. This process I am convinced will more than repay the cost entailed by the improved feeding value of the clover crops which follow.

The ideal of permanent pastures is readily taken up by the farmer, as it means a reduction of labour. The plough can be largely dispensed with. Unfortunately the introduction and appearance of the various pests to which Subterranean Clover is very susceptible has created the necessity

for the application of the principle of fallowing to check and steady up their increase. If this is not done, it would appear that the combined pests will so reduce the value of Subterranean Clover as to render it a very secondary fodder or grazing crop.

The spread of the weevil into new areas can be largely prevented by using only cleaned seed. There is always a danger that the weevil eggs have been laid upon the "burr" before being harvested.

Do not cart infested clover hay about, as this is a fruitful means of spreading the weevil. Seeing that this beetle has no long distance powers of flight, it is obvious that its spread must depend upon artificial means.

Destroy by fire all heaps of rubbish, long grass or weeds along headlands and fence alignments, as such places afford shelter to the over-summering weevils. Heaps of litter left about and regularly examined can be used as decoy traps. The beetles collect under these heaps, and if examined each day numbers of the adults can be destroyed.

To prevent the spread of any pest prompt action is essential. To sit back and chance what will happen next year is often to court disaster.

Treatment.—A number of experiments against this pest have been carried out, many of them giving negative results.

In this article it is only proposed to give those treatments which proved economically successful.

A bait composed of the following ingredients gave excellent results:—Bran, 30 lbs.; molasses, 4 lbs.; arsenate of soda or Paris green, 1 lb; water to bring to a consistency of a crumbling mash. This is sufficient for one acre of ground.

The bait is distributed in the evening along the line of advance of the weevil larvae. When the grubs come forth at night they discover the tempting bait and readily partake of it, resulting in their death.

It is not necessary to apply the bait to the area already denuded by the grubs, as they are only to be found on the edge of the still standing clover.

This operation repeated two or three times will completely wipe out a swarm.

Arsenate of lead used either as a spray or dust was also found to be an effective poison.

Formula.—Paste arsenate of lead 1 lb. or powdered arsenate of lead ½ lb., water 16 gallons. Spray along the edge of clover patch just in advance of the army of grubs. If using the dry powdered form as a dust, apply by means of a dusting machine in the same way, to the moist foliage.

In using any of the posion baits or sprays, it is essential to see that all poultry or cattle are kept from access to same until a period of at least three weeks has elapsed after the last application.

In conjunction with the application of the poisons the ploughing or cutting of a sharp trench in front of the weevils effectively checks their advance. They do not appear to be able to cross the ditch. Poison bait placed along the furrow will poison any that may fall into it.

It is a good plan to isolate each weevil patch by encircling with a trench, and then apply the poisons.

If the above recommendations are promptly applied, this pest can be controlled. If, however, it is allowed to extend its ravages it has very destructive possibilities, and might in time completely ruin any Subterranean Clover pasture into which it is introduced and established.

The life cycle is still being studied, and further experimental work is planned for the coming winter and spring.

Efforts are also being made to discover some natural enemies, and to this end Dr. Meyers, of the Imperial Bureau of Entomology, London, is, whilst in Brazil, looking out for any possible parasites, as it is suspected that this weevil originated in South America, being introduced into Australia.

Summary.

This pest appears in autumn, winter and spring.

The adult weevils aestivate or oversummer, hiding away in any suitable sheltered positions.

The eggs are laid upon the young plants in autumn.

The larvae feed gregariously, cleaning the crop up on a face.

Pupation takes place in latter August to the end of September.

First beetles emerge mid-September, main swarm October, November.

There is only one generation each year, with considerable overlapping.

Subterranean Clover appears to the favoured food plant.

Cape Weed and other plants are also attacked.

Indications of presence of weevil—bare patches in the field.

Weevil can readily be destroyed by spraying or dusting with arsenate of lead.

Poison bait can be used with good killing effect.

Ploughing a sharp trench ahead of the advancing weevil larvae will effectively check their advance.

Poison bait should be placed in the trench.

Fallow. This method of farming should be adopted for many reasons.

The turning in must be done by mid-September.

Keep fallow free from any plant growth.

Turn over land every third or fourth year.

The following autumn sow down to Oats and Subterranean Clover.

THE "ROYAL" AND DISTRICT AGRICULTURAL SOCIETIES' CROP COMPETITIONS.

I. THOMAS,
Superintendent of Wheat Farms.

The Royal Agricultural Society has promoted, during the past five years, competitions for wheat crops of not less than 50 acres of any one variety amongst the district Agricultural Societies in each of the eight zones into which the Wheat Belt has been divided for the purpose of these competitions. In each of the eight zones a championship prize is awarded for the best crop, also a second prize is awarded for the runner up, those eligible for these prizes being the first and second prize winners of the competitions held by the district Agricultural Societies, provided they are held in accordance with the conditions laid down by the Royal Agricultural Socety. These conditions require that the crop shall be grown on fallowed land, shall not be less than 50 acres in area of one variety and shall be judged according to the following scale of points:—

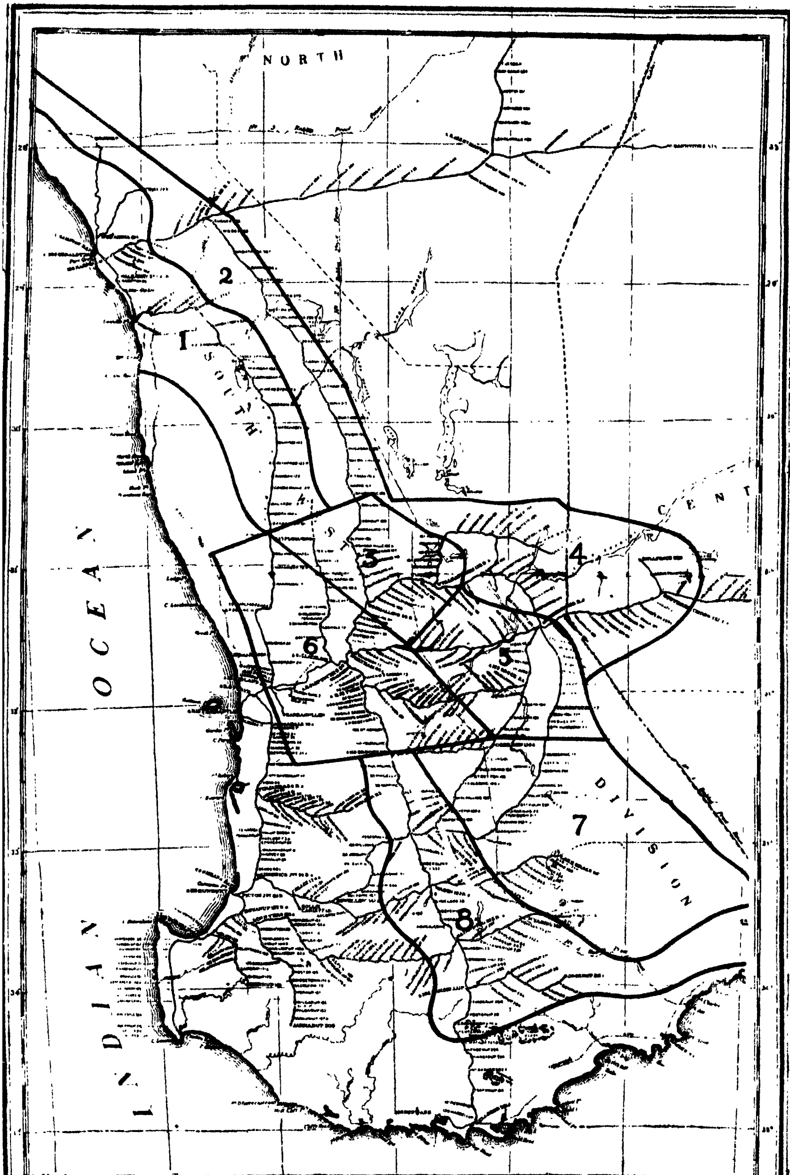
Yield	40
Freedom from weeds	20
Freedom from disease	15
Freedom from admixture	15
Eveness of growth	10
Total	100

The judges of the Royal Crop Competitions since their inception have been departmental officers attached to the Wheat Branch, and the same officers have also judged the majority of the district competitions. As it is obviously desirable that all the crops in any one zone should be inspected and the awards for the championship prizes made by the same judge, and as it is the definite and strong wish of many district societies that departmental officers should continue to judge their competitions, the zones are arranged so that the societies which are adjacent to each other and which have similar interests and climatic conditions, are grouped together. This requires the Wheat Belt to be divided into eight zones.

The eight zones into which the Wheat Belt is divided for the purpose of the competitions are as shown on the accompanying map.

In some districts the Agricultural Societies make no provision for crop competitions, and in order to prevent farmers who live in such districts being debarred from competing for the championship prize in their zones, the Royal Agricultural Society permits such farmers to enter for the competition directly through that Society.

The reports and awards made by the respective judges in the different zones are hereunder. The points awarded for yield are not based upon the estimated yield, but upon that calculated from portions of the crop obtained from small areas taken systematically throughout the crop. These portions of the crop are threshed and the grain weighed.



ZONE I.

Judge F. L. SHIER, B.Sc. (Agric.), Agricultural Adviser.

The competitors in this Zone numbered five, all of whom entered direct with the Royal Agricultural Society, three of the original nominators withdrawing before the final inspection.

The points were awarded as hereunder:—

TABLE 1.

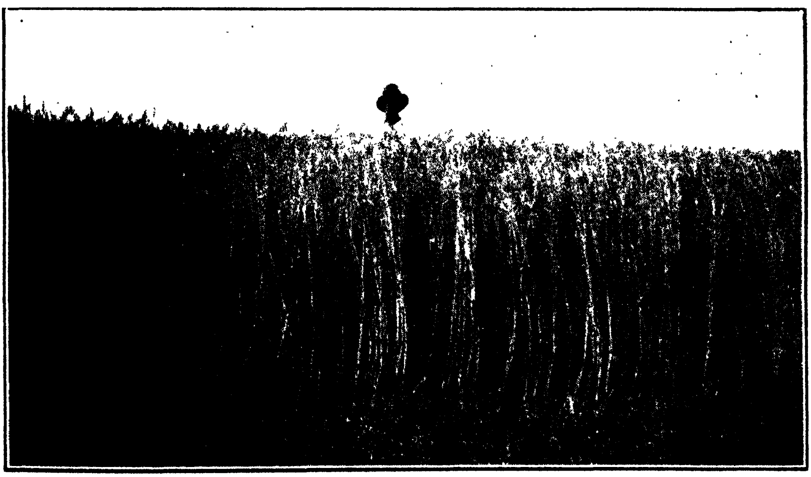
ROYAL AGRICULTURAL SOCIETY.

ZONE 1.

Judge: F. L. Shier. Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Admixture. 15 points.	Freedom from Disease. 15 points.	Evenness of Growth. 10 points.	Total. 100 points
Forrester, J. K.	Carnamah ...	Nabawa ...	35	16	13	14	9	87
Hebiton, J. K.	Three Springs	Merredin ..	30	16	13	13	9	81
Hunt, E. ...	Three Springs	Carrabin ...	28	15	14	14	8	79
Cuming Bros.	Inering ...	Nabawa ...	28	15	13	12	8	76
Bothe, B. D.	Coorow ...	Nabawa ...	24	14	14	13	7	72

The winning crop of Mr. J. K. Forrester of Dunester, Carnamah, was a very creditable one, of the popular variety "Nabawa," and was calculated to yield 35 bushels per acre. It was planted during the first week in May at the rate of 50 lbs. of graded seed, with an application of 110 lbs. of



J. K. Forrester's 50 acres "Nabawa."
Winner—Championship Prize, No. 1 Zone. Yield—35 bushels per acre.

Superphosphate per acre. The crop was of a good height, well stooled and very even. No disease was found, but an odd head of Barley and small quantities of wild oats and mustard were present. Sheep were pastured on the fallowed land previous to its being cropped.

The rainfalls as officially recorded at Carnamah, Three Springs and Coorow are shown in the following table for comparison.

—	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Carnamah	26	...	23	46	166	201	463	204	99	41	1,174	8	53	1,310
Three Springs	42	...	24	39	168	174	400	160	87	40	1,029	2	50	1,186
Coorow ...	25	...	23	57	195	144	414	186	106	62	1,107	4	58	1,274

The rainfall was rather light during the latter end of the season. At Mr. Forrester's from the first week of September to mid October only 37 points were recorded in six separate falls.

Mr. J. K. Hebiton's crop which gained second prize was of the variety "Merredin," and was calculated to yield 30 bushels per acre. It was planted early in June with 50 lbs. of graded seed and 112 lbs. of superphosphate to the acre. A few plants of wild oats, mustard and double gee were present, and also a trace of Loose Smut and Take-all.

Another creditable entry was that of Mr. E. Hunt. This was of the Premier Strong White Class, variety "Carrabin" and was calculated to yield 28 bushels to the acre. It was portion of a paddock of 60 acres and this yield tends to disprove the popular belief of the inability of the strong wheats to yield well.

The other entries were of a high standard and the average yield of 29 bushels per acre for this zone which is situated in the Midland Districts is very pleasing.

The cultural and cropping details of the various entries are shown hereunder for comparison.

TABLE 2.

ROYAL CROP COMPETITION.

ZONE 1.

Competitor ...	Forrester, J. K.	Hebiton, J. K.	Hunt, E.	Cumming Bros.	Bothe, B. D.
Years cropped	5 to 6. Cleared 1921	14	4th. All after fallow	7 to 10	Old land
Timber and land	Heavy red loam, York Gum and a little Salmon	Salmon Gum and Morrell	York Gum and a little Salmon Salmon	Salmon, Gimlet and Black Wattle	Salmon and York Gum
Ploughed and type of plough	Disc. June	July, half disc and half Mouldboard	First week July	Early June, Mouldboard	Disc ploughed, July
Depth ...	4in.	3½in. to 4in.	4in.	5in.	3in. to 4in.
Other cultivations	Springtyne cultivated Sept. and again Oct.	Harrowed twice Spring and early Summer. Ploughed after rain before seeding to kill weeds	Springtyne cultivated first week August, again Sept. and prior to seeding	Springtyne cultivated Sept.	Disced August and again Sept. Harrowed Oct. and disced before seeding
Variety ...	Nabawa	Merredin	Carrabin	Nabawa	Nabawa
Planted ...	Combined first week May	Disc drilled early June	Combined 20th May	Combined mid-May	Combined third week May

TABLE 2, ZONE 1—*continued.*

Competitor ...	Forrester, J. K.	Hebiton, J. K.	Hunt, E.	Cumming Bros.	Bothe, B. D.
Rate of seed...	50lbs.	50lbs.	48lbs.	60lbs.	60lbs.
Graded ...	Graded	Recleaned	Graded	Graded	Graded
Treated ...	Dry	Dry	Dry	Dry	Dry
Rate of super.	110lbs.	112lbs.	96lbs.	112lbs.	112lbs.
Disease ...	...	Trace loose Smut and a little Take-all	...	Trace Ball Smut	Trace Take-all
General ...	Sheep on fallow	Sheep on fallow. Three course system	Sheep on fallow	Sheep on fallow	Sheep on fallow

ZONE II.

Judge: F. L. SHIER, B.Sc. (Agric.), Agricultural Adviser.

For this zone five entries were submitted through the Dalwallinu Agricultural Society and two were received direct by the Royal Agricultural Society.

DALWALLINU AGRICULTURAL SOCIETY.

Two of the entrants from the Dalwallinu District withdrew prior to the inspection.

The awards made are as follows:

TABLE 3.

DALWALLINU DISTRICT AGRICULTURAL SOCIETY.

ZONE 2.

Judge: F. L. Shier, Agricultural Adviser.

Competitor.	District.	Variety	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Admixture. 15 points.	Freedom from Disease. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
R. J. Honner & Sons	Dalwallinu ...	Gluyas Early	25	16	13	14	9	77
F. C. Locke ...	Dalwallinu ...	Ford ...	20	15	13	14	7	69
Bradford Bros	Damboring ...	Nabawa ...	18	15	14	14	8	69
W. H. Sawyer	East Dalwallinu	Nabawa ...	15	17	13	14	8	67
W. M. Harris	Dalwallinu ...	Merredin ...	16	15	13	12	8	64

The rainfall recorded at Dalwallinu is as follows:—

——	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Dalwallinu	49	...	13	42	136	128	307	168	93	48	880	...	74	1,056

The winning entry of R. J. Honner and Sons was of the variety "Gluyas Early," and was calculated to yield 25 bushels per acre. This is

a very creditable yield and supports previous conclusions regarding the drought resisting qualities of this variety.

The crop was of a nice even height, and fairly well stooled, the heads being well filled with plump grain.

Odd heads of barley and a little mustard were present. No disease was noticed.

Mr. F. C. Locke and Bradford Bros, tied for second place.

Mr. Locke's entry was of the variety "Ford" and calculated to yield 20 bushels per acre. Points were lost, however, owing to the presence of Barley, mustard and heads of strange wheat varieties. The crop was uneven owing to the varying nature of the land. It had been fed off by sheep until the middle of June.

Messrs. Bradford Bros.' entry was "Nabawa," and was calculated to yield 18 bushels per acre. It was fairly even, but contained a fair quantity of mustard. Like all the crops in this district, it suffered considerably owing to the low rainfall.

Four of the competitors in this competition used the dry method for the prevention of Ball Smut and no disease was noticed.

The methods of cultivation of the competitors are summarised as hereunder:—

TABLE 4.

DALWALLINU DISTRICT CROP COMPETITION.

ZONE 2.

Competitor ...	Honner, R. J.	Locke, F. C.	Bradford Bros.	Sawyer, W. H.	Harris, W. M.
Years cropped	Fifth crop	6	8	Fairly new—1st fallow	5–6 crop. Cleared 14 years
Timber ...	Gimlet, Salmon and Tea-tree	Salmon, Gimlet and Morrell	Gimlet	Salmon and Gimlet	Salmon, Morrell, Gimlet
Ploughed and type of plough	Mouldboard, June	Mouldboard, end July	Disc, early June	Disced Sundercut early Aug.	June
Depth ...	4in.	3in. to 4in.	4in.	3in.	4in.
Other cultivations	Springtyne cultivated twice Spring and before seeding	Springtyne cultivated early Sept., again October, and prior to seeding	Springtyne cultivated in September	Disc cultivated in May	Cultivated twice in September
Variety ...	Gluyas Early	Ford	Nabawa	Nabawa	Merredin
Planted ...	12th May	Disc drilled 10th May	Combined early May	15th May	Combined third week May
Rate of seed...	60lbs.	58lbs.	60lbs.	50lbs.	50lbs.
Graded ...	Graded	Graded	Graded	Recleaned	Graded
Treated ...	Dry	Dry	Dry	Dry	...
Rate of super.	90lbs.	85lbs.	85lbs.	60lbs.	93lbs.
Disease ...	...	...	...	...	Trace Ball Smut and loose Smut

ROYAL AGRICULTURAL SOCIETY.

In Zone 2, two entries were received direct by the Royal Agricultural Society. The points awarded are as follow:—

TABLE 5.

ROYAL AGRICULTURAL SOCIETY.

ZONE 2.

Judge: F. L. Shier, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Admixture. 15 points.	Freedom from Disease. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Porter, F. A.	North Ajana	Nabawa ...	21	16	12	14	9	72
Meadowcroft Bros.	Ardingly ...	Toby's Tusk	20	16	12	14	9	71

The rainfall recorded at Ajana and Tenindewa is as follows:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Ajana ...	53	...	39	54	280	201	277	128	83	53	1,022	...	32	1,200
Tenindewa	16	30	95	75	213	136	259	103	46	37	794	10	70	1,090

Mr. Porter's crop, calculated to yield 21 bushels per acre, was of the variety "Nabawa." This farm is the most Northern wheat farm in West Australia, being located 10 miles north of the rabbit proof fence. Mr. Porter is to be congratulated on his enterprise in pioneering this new district.

The crop was of a nice even height, but points were lost owing to the presence of "strangers," barley and radish. No disease was noticed.

The cultural details of the two crops are as follows:—

TABLE 6.

ROYAL CROP COMPETITION.

ZONE 2.

Competitor	Porter.	Meadowcroft Bros.
Years cropped	Fairly new land. 1st fallow	...
Timber	York Gum	York Gum and Jam
Ploughed and type of plough	Sundercut. August	Mouldboard. June and July
Depth	3in.	4in.
Other cultivations	Disc cultivated in January	Springtyne cultivated September and again prior to seeding
Planted	Last week April	Disc drilled early May
Rate of seed	50lbs.	60lbs.
Graded	Recleaned	Recleaned
Treated	Dry	...
Rate of super.	112lbs.	80lbs.
Disease	...	...

Zone 3.

Judge: A. S. WILD, B.Sc. (Agric.), Agricultural Adviser.

Entries for Zone 3 were received from the Dowerin, Goomalling, Wongan Hills and Wyalkatchem Agricultural Societies.

DOWERIN AGRICULTURAL SOCIETY.

In the competition of the above Society, six competitors submitted crops for inspection. The points awarded are as hereunder:—

TABLE 7.

DOWERIN AGRICULTURAL SOCIETY.

ZONE 3.

Judge: A. S. Wild, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Cosh, E. C. ...	Minnivale ...	Merredin ...	24	19	12	14	9	78
Hughes, J. J. R.	Minnivale ...	Nabawa ...	26	17	12	14	8	77
Jones, J. S. ...	Ejanding ...	Nabawa ...	20	19	13	13	8	73
O'Loughlan, M. J.	Minnivale ...	Merredin ...	21	17	13	13	9	73
Thomas, T. ...	Dowerin ...	Nabawa ...	18	18	14	14	8	72
Jones, A. ...	Ejanding ...	Nabawa ...	17	18	13	14	8	70

Mr. E. C. Cosh's crop, which secured first place, was of the variety "Merredin." It was planted early in May at the rate of 45 lbs. of seed per acre with an application of 100 lbs. of superphosphate per acre. It was practically free of weed growth, very even, with little or no admixture. Traces of Flying Smut, Ball Smut and Flag Smut were noticed.

Mr. J. Hughes' crop of "Nabawa" although calculated to yield 26 bushels per acre, lost points for weeds and evenness of growth, and consequently was forced to take second place.

The rainfalls as officially recorded at Dowerin, Minnivale and Ejanding during the year were:—

	Jan.	Feb.	Mar.	Apl.	Useful Rains.						Total.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
Dowerin	93	...	62	40	126	164	352	146	88	23	899	14	12	1,120
Minnivale	42	...	118	10	125	125	306	259	95	22	932	2	34	1,138
Ejanding	...	...	64	12	104	82	333	204	87	25	835	3	58	972

The details of the cropping are as hereunder:—

TABLE 8

DOWERIN DISTRICT CROP COMPETITION.

ZONE 3.

Competitor ...	Cosh, F. C.	Hughes, J. R.	Jones, J. S.	O'Loughlan M. J.	Thomas, T.	Jones, A.
Years Cropped	Third crop	Old land worked on three-year rotation	Second crop	Third crop	Tenth crop	Fourth crop
Timber ...	Salmon Gum. Gimlet and Morrell. Sandy Loam	Salmon Gum and Gimlet	Light sand-plain to light Mallee	Light scrub and Tea-tree. good quality	Light country scrub, Jam and Tamma: occasional York Gum	Mainly Gimlet and white Mallee
Ploughed ...	Early August	July	July	June and July	Last week in July to end of August	July
Type of Plough	Disc	Mouldboard	Mouldboard	Disc	Disc	Disc
Depth ...	3 in.-4in.	4in.	2½in.	3in–3½in.	3in.	3½in.–4in
Condition of land at time of ploughing	Good	Fairly good	Favourable	Good	Good	Good
Other cultivations	Springtyne cultivated twice in September	Disced 2in. deep in September and again in May. Drilled with a Combine and growing crop rolled and harrowed	Springtyne cultivated in September and again in March. Drilled with a combine followed by heavy harrows	Crossed with Springtyne cultivator first week in October and again prior to seeding Drilled with a Combine	Disced with a sundercut immediately prior to drilling	Harrowed twice and disced with a Sundercut 2in. deep during Spring. Again with a Sundercut in April and drilled with a Combine
Variety ...	Merredin ...	Nabawa	Nabawa	Merredin	Nabawa	Nabawa
Planted ...	Early May	3rd and 4th week in May	1st week in June	2nd or 3rd week in May	Last week in April to end of May	First week in May
Rate of Seed	45	45	60	75	40	55
Graded ...	Recleaned	Yes	Yes	Recleaned	Yes	Yes
Treated ...	Dry pickled	Dry pickled	No	Pickled with bluestone	Pickled with bluestone	Dry pickled
Rate of Super	100	100	90	120	100	100
Disease ...	Slight infection with Flying Smut. Ball Smut and Flag Smut	Trace of Ball smut and Flying smut. Small patches of Take all	Traces of Ball and Flying Smuts	Flag Smut and trace of Flying Smut	Slight infection with Take-all	Trace of Ball Smut

GOOMALLING AGRICULTURAL SOCIETY.

Of the five entries received through the above Society, four competitors submitted crops for inspection.

The points awarded were set out as hereunder:—

TABLE 9.

GOOMALLING AGRICULTURAL SOCIETY.

ZONE 3.

Judge: A. S. Wild, Agricultural Adviser.

Competitor.	Society.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Sawyer, T. G.	Goomalling ...	Nabawa ...	30	18	12	13	8	81
French, E. D.	Goomalling ...	Nabawa ...	20	17	14	13	8	72
Anstey & Sheen	Goomalling ...	Nabawa ...	20	16	13	13	7	69
Waterhouse, F. W.	Goomalling ...	Caliph ...	18	18	13	13	7	68

Mr. T. G. Sawyer's crop of "Nabawa" secured first place with the creditable calculated yield of 30 bushels per acre. This was an attractive looking, well headed crop, which was unfortunately marred by the prevalence of Ball Smut, this appreciably reducing the yield. In addition, there were small patches of Takeall. The crop, however, was, with the exception of a few plants of mustard, canary grass and oats, comparatively clean of weeds and was very even in growth.

The admixture was confined to a few heads of barley and strange varieties of wheat.

The Goomalling Agricultural Society is to be congratulated on this, its entry into the Competition. It is hoped that the future may show more entrants from this district and a consequent participation in the benefits derived from the same.

The rainfall as officially recorded at Goomalling during the year is set out hereunder:—

...	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Goomalling	98	...	46	45	157	138	378	144	90	29	936	8	114	1,247

The details of the methods adopted by the Competitors are as hereunder:—

TABLE 10.

GOOMALLING DISTRICT CROP COMPETITION.

ZONE 3.

Competitor ...	Sawyer, T. G.	French, E. D.	Anstey & Sheen.	Waterhouse F. W.
Years cropped ...	Fourth crop ...	Sixteenth crop ...	Over 20 years cropped	Second crop
Timber	Morrell, Salmon Gum, York Gum, first class loam	Jam and York Gum and some Gimlet	Salmon Gum, York Gum	Sheoak, Jam, little York Gum
Ploughed	July and August	August	End July early August	July
Type of plough ...	Mouldboard	Mouldboard	Mouldboard	Disc
Depth	4in.	4in.	4in.	4in
Condition of land at time of ploughing	Good	Good	Good	Good
Other cultivations	Springtyne cultivated in March. Drilled with a combine	Springtyne cultivation prior to drilling with a disc drill with drag harrows. Part rolled before drilling	Part Springtyne cultivated in September and whole prior to seeding. Part rolled just after seeding	Disced 4in. deep immediately prior to seeding
Variety	Nabawa	Nabawa	Nabawa	Caliph
Planted	May	24th May	Mid-May	1st fortnight in June
Rate of seed ...	64	60	75	60
Graded	Yes	Recleaned	Recleaned	Recleaned
Treated	Wet pickled	Dry pickled	Dry pickled	Dry pickled
Rate of Super. ...	100	90	90	140
Disease	Trace Take-all and some Bunt	...	Trace of Take-all	Traces of Ball Smut and Flying Smut

WONGAN HILLS AGRICULTURAL SOCIETY.

The above Society conducted a double competition, two classes of land, heavy and light, determining the distinction. For the purposes of zone competitions all the crops were judged as being in the one class. The awards made are as hereunder:—

TABLE 11.

WONGAN HILLS AGRICULTURAL SOCIETY.

ZONE 3.

Judge: A. S. Wild, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Bryan, P. A.	Wongan Hills	Nabawa ...	29	18	14	13	8	82
Slater, W. G....	Wongan Hills	Nabawa ...	27	18	13	13	9	80
Ackland, R. B.	Wongan Hills	Merredin ...	26	18	13	14	8	79
Martin, P. ...	Wongan Hills	Nabawa ...	23	19	14	13	8	78
Ackland, J. H.	Wongan Hills	Nabawa ...	24	18	13	14	8	77
Gorman, P. W.	Wongan Hills	Nabawa ...	24	18	13	12	9	76
Mt. Rupert Estate	Wongan Hills	Ford ...	22	18	13	13	8	74
Booth, W. J....	Kokardine ...	Nabawa ...	21	18	13	13	8	73
Herbert Bros.	Wongan Hills	Wilfred ...	18	19	13	12	8	70
Leeson, P. W.	Wongan Hills	Nabawa ...	15	19	14	13	7	68
Parker, C. A....	Wongan Hills	Nabawa ...	16	15	13	13	7	64

Mr. P. A. Bryan and Mr. W. G. Slater, each with the variety "Nabawa" secured first and second place respectively. The winning crop was planted during the fourth week in May at the rate of 44 lbs. per acre with an application of 84 lbs. per acre of superphosphate. The land, which produced this clean, even crop, had been ploughed during the previous June and July. The calculated yield was 29 bushels.

Mr. Slater's crop was also an early fallowed land which had been treated with 100 lbs. of superphosphate per acre. This was also very even in growth, well stooled and headed and comparatively free from weed growth and admixture.

The rainfalls as recorded at Wongan Hills and Kokardine are as hereunder:—

——	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Wongan Hills	45	...	44	90	106	110	251	157	97	42	763	...	81	1,023
Kokardine	62	2	24	19	164	91	280	167	79	46	827	6	23	963

The cultural details as employed by the competitors are as set out in the table hereunder:—

TABLE 12

WONGAN HILLS DISTRICT CROP COMPETITION.

ZONE 3.

Competitor	Bryan, P. A.	Slater, W. G.	Ackland, R. B.	Martin, P.	Ackland, J. H.	Gorman P. W.
Years cropped	2nd crop	1st crop	9th crop	2nd crop	About tenth crop	2nd crop
Timber ...	Salmon Gum, Gimlet and Yorrell	York Gum and Jam	Salmon Gum and Yorrell	Sand plain, smoke-bush and tussocks	Salmon Gum, Gimlet and a little Morrell	Tamma scrub-plain
Ploughed ...	Middle June to middle July	End of June Early July	July	August	June	Late July
Type of plough	Mouldboard	Disc	Disc	Disc	Mouldboard	Disc
Depth ...	3½ to 4 inches	3½in.	3½in.	3½in.	3½in. to 4in.	4in. to 5in
Condition of land at time of ploughing	Good	Good	Very good	Good	Ideal	Good
Other cultivations	Cultivated with Springtyne duck-foot machine early in Sept. and late in Oct., and again immediately before drilling	Disc cultivated 2in. deep prior to seeding and light harrows dragged behind drill	Springtyne cultivated in August, again Sept. and again in April. Planted with a combine drill with drag harrows	Ploughed back early in Oct. Disc cultivated before seeding	Spring-tyne cultivated twice in spring and twice after the first rains in 1928. Drilled in with a combine	Springtyne cultivated in March. Drag harrowed when drilling
Variety ...	Nabawa	Nabawa	Merredin	Nabawa	Nabawa	Nabawa
Planted ...	23rd to 30th May	12th to 20th April	End of May and beginning June	25th May	18th to 21st May	Middle of May
Rate of seed	44lbs.	60lbs.	50lbs.	45lbs.	55lbs.	60lbs.
Graded ...	Yes	Yes	Yes	Yes	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Seed treated for the previous year	Dry pickled	Dry pickled	Dry pickled
Rate of Super	84lbs.	100lbs.	123lbs.	112lbs.	114lbs.	120lbs.
Disease ...	...	Traces Rust, Septoria and Flying smut	Flag smut	...	Small patches of Take-all	Traces of Take-all and Septoria

TABLE 12, ZONE 3—*continued.*

WONGAN HILLS DISTRICT CROP COMPETITION—*continued.*

Competitor	Mt. Rupert Estate.	Booth, W. J.	Herbert Bros.	Leeson, P. W.	Parker, C. A.
Years cropped	Eight years	Fourth crop	First crop	First crop	Cropped about fifteen years
Timber ...	Salmon Gum, Gimlet and Morrell	Gimlet and Salmon Gum	Sand plain, odd patches of stunted mallee	Tea-tree, sandy soil	Salmon Gum, Gimlet and Morrell
Ploughed ...	July	August	July	July and August	July
Type of Plough	Disc	Mouldboard	Disc	Disc	Mouldboard
Depth ...	4in.	4½in.	3in.	3in. to 4in.	3in. to 3½in.
Condition of land at time of ploughing	Dry	Good	Good	Good	Good
Other cultivations	Springtyne cultivated in August, harrowed in Sept. and again in Mar. Drilled with a combine	Not cultivated prior to seeding with a combine	Ploughed back beginning May to about 2in. to 3in. and drilled	Tandem disc, cultivated 2in. deep prior to drilling	Springtyne cultivated twice in Sept. Harrowed at the end of Feb. after rain
Variety ...	Ford	Nabawa	Wilfred	Nabawa	Nabawa
Planted ...	2nd week in May	Mid-May	15-20th May	End of April Early May	Middle of May
Rate of seed	60lbs.	60lbs.	60lbs	60lbs.	65lbs.
Graded ...	Yes	Yes	Recleaned	Yes	Yes
Treated ...	Dry pickled ...	No	Dry pickled	Dry pickled	Dry pickled
Rate of super.	110lbs.	90lbs.	105lbs.	120lbs.	120lbs.
Disease ...	Flag Smut. Trace Ball Smut	Trace Ball Smut	Trace of Septoria. Trace Ball Smut.	...	Take-all. Trace Ball Smut

WYALKATCHEM AGRICULTURAL SOCIETY.

Ten competitors submitted their crops for inspection in the competition of the Wyalkatchem Agricultural Society.

The awards made were as hereunder:—

TABLE 13.

WYALKATCHEM AGRICULTURAL SOCIETY.

ZONE 3.

Judge: A. S. Wild, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Whittingham, T. M.	Nalkain ...	Merredin ...	22	18	14	14	9	77
McKay, N. ...	Benjabbering	Merredin ...	23	18	14	13	8	76
Threlfall, G. H.	Korrelocking...	Nabawa ...	21	18	14	14	8	75
Tyler, J. E. ...	Korrelocking...	Merredin ...	20	18	14	14	8	74
Ferries, H. G....	Wyalkatchem	Nabawa ...	21	18	13	12	8	72
Harrison, L. & Sons	Benjabbering	Gresley ...	22	17	13	13	7	72
Payne, Mrs. ...	Korrelocking	Nabawa ...	17	19	14	14	8	72
Grace, W. H.	Wallambin ...	Nabawa ...	20	16	12	12	8	68
Lehman, C. E.	Cowcowing ...	Gluyas Early	19	17	12	12	8	68
Allan, A. ...	Korrelocking	Nabawa ...	15	15	12	12	7	62

Between many of the crops inspected, there was but little to choose. Mr. T. M. Whittingham of Nalkain, who secured first place, although not having the highest calculated yield, gained points for freedom from disease and admixture, and evenness of growth.

In view of the climatic conditions of 1928 it cannot be expected that this district should be as successful as it was the previous year. Notwithstanding this, however, the crops were well worthy of the competition.

The rainfall as officially recorded at Wyalkatchem, Korrelocking, Benjabbering, Cowcowing, Wallambin and Nalkain was:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Wyalkatchem	56	...	128	12	91	131	297	200	96	28	843	8	6	1,053
Korrelocking	35	...	113	8	97	138	297	159	93	26	810	7	76	1,049
Benjaberbering	50	...	62	9	97	85	301	209	85	19	796	19	...	...
Cowcowing	112	...	35	40	110	73	292	174	64	27	760	4	70	1,021
Wallambin	85	...	43	47	87	55	256	123	45	22	588	8	74	845
Nalkain	69	...	30	44	102	81	315	125	60	20	703	...	...	...

The cropping details of the crops inspected are as hereunder:—

TABLE 14.

WYALKATCHEM DISTRICT CROP COMPETITION.

ZONE 3.

Competitor ...	Whittingham, T. M.	McKay, N.	Threlfall, G. H.	Tyler, J. E.	Ferrie, H. G.
Years cropped	About 10 years	..	Fifth crop	Eighth crop	Fifth crop
Timber ...	Mixed loam, Salmon Gum, York Gum and Gimlet	Salmon Gum, Gimlet and Tea-tree	Mixed Mallee and Gimlet with little Salmon Gum	York Gum, Jam and Mallee, Gimlet and Salmon Gum	Mallee, light scrub and Pear plain
Ploughed ...	July	End of August	June	June	End of June and early July
Type of plough	Disc	Disc	Mouldboard	Mouldboard	Mouldboard
Depth ...	4½in.	3in.	3½in to 4in.	4in.	4 to 4½in.
Condition of land at time of ploughing	Good	Good	...	Very good	Good
Other cultivations	Disced 3in. deep in Sept., and Springtyned cultivated before seeding	Skim-ploughed early in Sept., Springtyned cultivated prior to seeding and harrowed immediately after seeding	Scarified three times up to early October. Harrowed at the end of March and drilled with a combine	Turned back with disc in August 2in. deep. In Sept. cultivated with springtyne implement followed by harrows. Harrowed in Oct. and Springtyne cultivated prior to seeding. Drilled with combine folwed by light roller	Disced 3in. deep early in Sept., and Springtyne cultivated with duckfoot points at the beginning of Oct. Drilled with combine
Variety ...	Merredin	Merredin	Nabawa	Merredin	Nabawa
Planted ...	Middle to end of May	1st week in June	27th April to 1st May	25th April	1st week in May
Rate of seed...	60lbs.	60lbs.	50lbs.	60lbs.	60lbs
Graded ...	Yes	Yes	Yes	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	No
Rate of super.	60lbs.	90lbs.	110lbs.	125lbs.	100lbs.
Disease ..	Trace of Flying Smut	Trace of Flying Smut	...	Trace of Flying Smut	Trace of Smut

TABLE 14, ZONE 3—*continued.*

WYALKATCHEM DISTRICT CROP COMPETITION—*continued.*

Competitor ...	Harrison, L., & Sons.	Payne, Mrs.	Grace, W. H.	Lehman, C. E.	Allan, A.
Years cropped	Fourth crop	Third crop	Cropped for 18 years	Sixth crop	Eighth crop
Timber ...	Salmon Gum and Gimlet, Jam running to Wodgil	Scrub land, sandy with small patch of heavy land	Pure Gimlet	Mainly Salmon Gum and Gimlet	Salmon Gum and Gimlet with some Mallee
Ploughed ...	June	1st week in Aug.	July	July	July
Type of plough	Disc	Disc	Disc	Mouldboard	Mouldboard
Depth ...	3in.	4in.	4in.	4in.	3½in. to 4in.
Condition of land at time of ploughing	Good	Good	Good generally	Good	Good
Other cultivations	Redisced 2in. deep in Sept. Springtyne cultivated prior to seeding.	Cultivated with a springtyne implement end of Sept. Drilled with a combine	Springtyne cultivated in Sept. Drilled with combine	Two springtyne cultivations in Sept. with one harrowing and drilled with a combine	Disced to 2½in. deep during October; cultivated in Feb. and drilled with a combine
Variety ...	Gresley	Nabawa	Nabawa	Gluyas Early	Nabawa
Planted ...	2nd week in April	Middle April	3rd week in May	26th May	1st week in May
Rate of seed ...	45lbs.	45lbs.	45lbs.	57lbs.	50lbs.
Graded ...	Recleaned	Yes	Yes	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of super.	90lbs	120lbs.	75lbs.	80lbs.	90lbs.
Disease ...	Slight infection of Flag and Flying Smuts	...	Trace of Flying Smut with patches of Take-all	Fair amount of Ball Smut; little Flag Smut	Take-all

Zone 4.

Judge: G. L. THROSSELL, (Dip. Agric.), Agricultural Adviser.

Entries in Zone 4 were received through the Mt. Marshall and Nungarin Agricultural Societies. Since the crop competition conducted by the Nungarin Agricultural Society was subsequent to a fallow competition, certain farmers in the district who had not entered in the Society's Fallow Competition found it necessary to enter direct with the Royal Agricultural Society.

MT. MARSHALL DISTRICT AGRICULTURAL SOCIETY.

Four entries were received for this competition, but of these only two submitted their crops, one competitor having withdrawn and the other commenced stripping.

The points were awarded as hereunder:—

TABLE 15.

MT. MARSHALL DISTRICT AGRICULTURAL SOCIETY.

ZONE 4.

Judge: Gerald L. Throssell, Agricultural Adviser.

Competitor.	District.	Variety.	Estimated Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Dunkley, G. A.	Yelbeni ...	Gluyas Early	22	19	13	14	9	77
Hopwood, H. W. C.	Bencubbin ...	Gluyas Early	17	18	14	12	8	69

The winning crop, submitted by Mr. G. A. Dunkley of Yelbeni was of the variety Gluyas Early. The land originally carried Gimlet, Mallee and Tea-tree timber, and had been cropped since 1912. The fallowing was done in July to a depth of 4in. with a mouldboard plough and received three cultivations, all with the Springtyne implement. The first was in September, to the full depth of ploughing, another after rain in November and a final stroke before seeding—the last two cultivations being shallower. The crop was planted with a combined cultivator and drill during the third week in May with 60 lbs. of graded seed, and 120 lbs. of Superphosphate per acre.

This crop, which gained 77 points, was calculated to yield 22 bushels per acre. It was very dense and considering the season, had made very good growth. Although the seed had not been pickled, it was free from Bunt, but there was a trace of both Flag Smut and Take-all. The crop was very true to type, the only admixture found being a trace of barley. The little unevenness was due to a few sandy pockets.

Mr. B. W. G. Hopwood of Bencubbin gained second place with 69 points, with a crop of Gluyas Early which was calculated to yield 17 bushels per acre.

The land has carried eleven crops since 1911. The original timber was mainly Gimlet, verging into Tea-tree. Fallowing operations were carried out in August, the land being ploughed to a depth of 4in. with a mouldboard plough, after which no further cultivation was done until March when a disc cultivator was used to break down the clods. Seeding took place during the middle of May—a "combine" being used. The seed, which was both graded and dry pickled, was sown at the rate of 45 lbs. per acre, and Superphosphate at 100 lbs. per acre.

On account of a shortage of green feed, Mr. Hopwood was forced to feed his crop off heavily with sheep during the month of July. Under these circumstances it is remarkable that despite the very adverse season, the crop did so well. The crop was rather thin and patchy. It was free of "Take-all" but was slightly affected by the Smuts—Flag Smut, Loose Smut and Bunt. The weeds, which were mainly growing on hard patches, were Mustard and Potato weed.

The rainfall recorded by the Competitors for 1928 to end of October is as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total, May to Oct.
G. A. Dunkley, Yelbeni	...	...	100	...	161	78	239	217	82	14	790
B. W. G. Hopwood, Bencubbin	75	...	37	85	120	43	251	123	51	24	612

The winning crop received nearly two inches more rain than the other, but both had very critical periods in June, September and October. This light rainfall towards the end of the growing period was spread over too many days to be of much benefit to the growing crop. However the cool weather towards maturity minimised to some extent the formation of pinched grains:—

The following table summarises cultural methods adopted by the competitors:—

TABLE 16.

MT. MARSHALL CROP COMPETITION.

ZONE 4.

Competitor	G. A. Dunkley.	B. W. G. Hopwood.
Years cropped	Since 1912 about 11 crops	Since 1911—about 11 crops
Rotation	2 years fallow-crop	2 years fallow-crop
Timber	Gimlet, Mallee and Tea-tree	Gimlet verging into Tea-tree
Ploughed	Middle July	August
Type of plough	Mouldboard	Mouldboard
Depth	4ins.	4in.
Condition of land at time of ploughing	...	...
Other cultivations	Springtyned to depth of ploughing in September, after rains in November and before seeding	Cultivated in March with a double gang disc
Variety	Gluyas Early	Gluyas Early
Planted	3rd week in May	Middle May
Type of drill	Combine	Combine
Rate of seed	60lbs.	45lbs.
Graded	Yes	Yes
Treated	No	Yes—dry pickled
Rate of super.	120lbs.	100lbs.
Fed off	No	Very heavily in July
Age of seed	3rd year from Merredin	3rd year from Merredin
Disease	Trace of Flag Smut and Bunt · Take-all	Trace of Flag and Loose Smuts

NUNGARIN-EASTERN DISTRICTS AGRICULTURAL SOCIETY

Fifteen entries were received for the Nungarin-Eastern Districts Agricultural Society Crop Competition. As a result of the adverse season, however, ten withdrew.

The season has been a very trying one for farmers generally. There were no spring and summer rains and the autumn rains were very light. The lateness of the seeding rains delayed germination for some time after seeding. Consequently the crops were much later and the weed growth more prolific. The falls of rain during the winter were generally very light, only one or two good soaking rains being experienced. The season finished off very quickly, with little or no rain worth speaking about during the months of September or October. Cool weather prevailed during the ripening period and minimised to some extent the formation of pinched grain. It was indeed gratifying to note how well the competitors' crops were stripping.

The rainfall for the years up to the end of October was as follows:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total, May to Oct.
Talgomine	39	...	83	86	69	53	217	139	49	19	546
Kwelkan	69	...	65	98	108	93	328	206	83	18	836
Mangowine ...	70	...	63	78	102	39	209	139	62	11	562

The points awarded to the competitors are set out in the following table:—

TABLE 17.

NUNGARIN AND EASTERN DISTRICTS AGRICULTURAL SOCIETY.

ZONE 4.

Judge: G. L. Throssell, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Young, G. T. ...	Talgomine ...	Gluyas Early	24	19	14	15	8	80
Creagh Bros. ...	Kwelkan ...	Nabawa ...	22	18	14	14	9	77
Williams, F. A.	Mangowine ...	Gluyas Early	20	17	10	14	9	70
Dumsday, L.	Talgominé ...	Nabawa ...	16	17	14	14	7	68
Johnson, J. H.	Mangowine ...	Nabawa ...	16	17	12	14	7	66

Mr. G. T. Young of Talgomine won the competition with a crop of "Gluyas Early," calculated to yield 24 bushels per acre. It was sown on July fallow on 20th May with a disc drill. The seed was sown and super was applied at 45 lbs. and 95 lbs. respectively. This entry was a very fine crop, true to type, very free of weeds and disease, and its only apparent defect was its unevenness—caused by crabholes.

Messrs Creagh Bros. were awarded second place with a crop of "Nabawa" calculated to yield 22 bushels per acre. It was sown on July fallow on 19th and 20th April with 40 lbs. of seed and an application of one cwt. of Superphosphate per acre. This crop has stooled well and had made good growth. It was a little uneven and weeds were fairly evident in patches. It was not as true to type as the winning entry, there being a few heads of other varieties present. A slight infection of Take-all was noticed.

The cultural methods of all competitors are summarised below:—

TABLE 18.

NUNGARIN-EASTERN DISTRICTS CROP COMPETITION.

ZONE 4.

Competitor ...	G. T. Young.	Creagh Bros.	F. A. Williams.	L. Dunsday.	J. H. Johnson.
Years cropped	4 crops	Since 1911	5 crops	...	...
Rotation ...	2 years fallow-crop	3 years fallow, crop and stubble	2 years fallow-crop	...	2 years fallow-crop
Timber ...	Salmon and Gimlet	Salmon and Gimlet	Salmon and Gimlet	Gimle and Tea-tree	Salmon and Gimlet
Ploughed ...	July	Mid-July	July	July	End June
Type of plough	Mouldboard	Disc.	Mouldboard	Disc	Disc
Depth ...	3in. to 4in.	3in. to 4in.	4in.	3½in.	4in.
Condition of land at time of ploughing	...	...	...	...	...
Other cultivations	Skim ploughed in Sept. with a Sundercut. Springtyned & harrowed in March, again in April. Harrowed after drilling	Skim ploughed in October	Harrowed in August. Duck foot scarified in Sept.	Scarified in August. Harrowed in November	Sundercut in August. and second week in February.
Variety ...	Gluyas Early	Nabawa	Gluyas Early	Nabawa	Nabawa
Planted ...	20th May	25th 26th April	3rd week May	19th–20th April	1st week May
Type of Drill...	Disc	Combine	Combine	Combine	Combine
Rate of seed ...	45lbs.	45lbs.	45lbs.	40lbs.	45lbs.
Graded ...	Yes	Yes	Yes	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of super.	90lbs.	90lbs.	60lbs.	112lbs.	80lbs.
Disease ...	Trace of Flag Smut and Bunt	Take-all	Flag Smut very bad. Trace of Take-all	Take-all	Take-all

ROYAL AGRICULTURAL SOCIETY.

As explained previously three competitors from the Nungarin and Eastern districts entered direct with the Royal Agricultural Society.

The points awarded these competitors are shown hereunder:—

TABLE 19.

ROYAL AGRICULTURAL SOCIETY.

ZONE 4.

Judge: G. L. Throssell, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Payne, H. ...	Nungarin ...	Merredin ...	22	19	14	12	8	75
Reynolds, A. G.	Mukinbudin ...	Gluyas Early	17	20	14	14	9	74
Richardson, J.	N. Mukinbudin	Nabawa ...	17	19	14	11	9	70

The winning crop of "Merredin," grown by Mr. H. Payne of Nungarin, was awarded 75 points and was calculated to yield 22 bushels per acre. The soil was of a nature suited to the season, being a mixture of Salmon Gum, Gimlet, Jam and Mallee. The land was ploughed in early July and received two workings in the spring, the first with a disc implement; the second with a springtyne cultivator. Seeding took place on May 20th, 50 lbs. of seed with 80 lbs. of superphosphate per acre being sown with a combined drill and cultivator. It was a very attractive looking crop, being well grown, dense and very free of weeds. However, it was rather uneven and contained a fair amount of admixture. It was free of Take-all and Bunt, but traces of both Flag and Loose Smuts were present.

Mr. A. G. Reynolds of Mukinbuddin gained second place with a nice crop of "Gluyas Early" on new land fallowed early in June of the previous year. It was sown on 16th May with 36 lbs. of seed and 92 lbs. of superphosphate per acre. Mr. Reynold fed this crop off very heavily with sheep towards the end of June and early July. This no doubt reduced the wheat yield but it enabled him to carry his sheep over a period when feed was very scarce. Being new land, the crop was free of weeds. It was very true to type, there being an odd admiture only. The only diseases present were traces of the Flag and Ball Smuts.

The season had been a very unfavourable one. June was well below the average and the rainfall during September and October fell in very light showers spread over a number of days. The winning crop received over an inch and a quarter more rain than that of the two other competitors. The rainfall recorded on the farms of the competitors is given below.

—	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total, May to Oct.
Nungarin	49	...	84	108	127	76	238	199	80	14	734
Muckinbudin ...	63	...	52	61	103	90	218	119	52	14	596
N. Mukinbudin ...	112	...	72	68	112	53	243	126	49	30	613

The cultural methods of the competitors are summarised in the following table:—

TABLE 20.

CROP COMPETITION.

ZONE 4

Competitor ...	H. Payne.	A. G. Reynolds.	J. Richardson.
Years cropped ..	Three crops	First crop	2nd crop
Timber	Salmon, Gimlet, Jam and Mallee	Gimlet, Salmon and Mallee	Salmon, Gimlet and Tea-tree
Rotation	...	New land—fallowed	Two years fallow—crop
Ploughed	Early July	Early June	June
Type of plough ...	Sundercut	Sundercut	Disc
Depth	4in.	3in.	4in.
Condition of land at time of ploughing	...	..	...
Other cultivations .	Crossed with Sundercut end of August. Cultivated with Springtyne in October	Cultivated with a Springtyne to full depth end July. Cultivated with a Combine followed by harrows in October	Cultivated mid-August with Springtyne, again in March. Harrowed after seeding
Variety	Merredin	Gluyas Early	Nabawa
Planted	20th May	16th May	20th April
Type of drill ...	Combine	Combine	Combine
Rate of seed ...	50lbs.	38lbs.	45lbs.
Graded	Yes	Yes	Yes
Treated	Dry pickled	Dry pickled	No
Rate of super. ...	80lbs.	92lbs.	90lbs.
Disease	Trace of Flag and Loose Smut	Trace of Flag Smut and Bunt	Trace loose Smut

ZONE 5.

Judge: I. THOMAS, Superintendent of Wheat Farms.

In this Zone the Bruce Rock Doodlakine-Baandee and Merredin Agricultural Societies were represented. In addition one entry was received direct by the Royal Agricultural Society.

BRUCE ROCK AGRICULTURAL SOCIETY.

This Society provided for a fallow and crop competition of 50 acres in addition to one for crops only.

The awards made for the cropping section of the former are as follow:—

TABLE 21.

BRUCE ROCK AGRICULTURAL SOCIETY.

ZONE 5.

Awards for Crops in Crop and Fallow Competition.

Judge: I. Thomas, Crop Superintendent of Wheat Farms.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Mann, R. ...	Shackleton ...	Gluclub ...	23	18	14	13	8	76
Buller & Black	Babakin ...	Nabawa ...	23	18	14	13	8	76
Harling, H. H.	Belka ...	Nabawa ...	20	18	13	14	7	72
Smith, C. & Sons	Yarding ...	Gluclub ...	20	18	13	13	7	69

The crop submitted for inspection by Mr. R. Mann was of the variety "Gluclub" and was part of 180 acres of the same variety. It was planted during the last week of April at the rate of 60 lbs. of seed per acre. The seed had been recleaned and treated with copper carbonate. Superphosphate had been applied at the rate of 110 lbs. per acre. The crop was fairly well grown over the greater part of the area but it had not stooled evenly nor was it even in height. It was fairly free of weed growth and admixture, only a trace of barley being noticed. Except that Septoria was present, it was free of disease.

The 50 acres of crop submitted by Messrs. Buller and Black was part of 160 acres "Nabawa" and, like Mr. Mann's crop, with which it tied for first place, it was not regular in height or stooling, but was fairly free of weeds and disease. A little Take-all was noticed and a few plants of another variety were present. The seed which had been graded and pickled with copper carbonate was planted during the first week of June at the rate of 60 lbs. of seed with an application of 95 lbs. of superphosphate per acre.

The cultural details of the crops inspected are tabulated hereunder:—

TABLE 22.

BRUCE ROCK DISTRICT CROP AND FALLOW COMPETITION.

Competitor ...	Mann, R.	Buller & Black.	Smith, C., & Sons.	Harling, H. H.
Years cropped ...	Four	Four at least	Ten at least	Fourteen
Timber	Salmon Gum, Gimlet and Mallee	Jam, Gimlet, Salmon Gum, White Gum, Mallee and scrub	Salmon Gum and Gimlet	Salmon and Gimlet
Ploughed	End of July	July and August	June	July
Type of plough ...	Mouldboard	Sundercut	Mouldboard	Mouldboard and Disc
Depth	4in.	3in to 4in.	3in.	4in.
Condition of land at time of ploughing	Good	Good	Good	Good
Other cultivations	Cultivated with duckfoot scarifier in August, again Sept. with harrows attached. Planted with Combine	Cultivated with a duckfoot machine in Sept. again early in Oct. with harrows attached, and late portion harrowed	Sundercut in Aug. and again in Sept. Combine drilled	Cultivated during August, again in Sept. Drilled with a combine
Variety	Gluclub	Nabawa	Gluclub	Nabawa
Planted	3rd 4th week April	1st week June	Early in May	20th–25th May
Rate of seed ...	60lbs.	60lbs.	48lbs.	45lbs.
Graded	Recleaned	Yes	Yes	Yes
Treated	Dry pickled	Dry pickled	Dry pickled	No
Rate of super. ...	110lbs.	95lbs.	88lbs.	100lbs.
Disease	Traces of Septoria	Trace of Take-all	Take-all and a trace of Flag Smut	Ball Smut and Take-all

The awards made in connection with the crop competition conducted by the same society are as hereunder:—

TABLE 23.

BRUCE ROCK AGRICULTURAL SOCIETY.

ZONE 5.

Judge: I. Thomas, Superintendent of Wheat Farms.

Name.	Address.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total 100 points
Strange, P. A.	Yarding ...	Gluclub ...	25	19	13	14	8	79
Smith, C. & Sons	Yarding ...	Gluclub ...	25	18	13	14	8	78
Faulkner, D. H.	Babakin ...	Gluclub ...	23	18	13	14	9	77
Mann, R. ...	Shackleton ...	Gluclub ...	23	18	14	13	8	76
Foss, I. & J. S.	Ardath ...	Nabawa ...	20	19	14	13	8	74
Harling, H. H.	Belka ...	Nabawa ...	19	18	13	14	7	71
Starcevich, J....	Korbel ...	Nabawa ...	16	18	13	13	7	67

The crop submitted by the winner, Mr. P. A. Strange, was 50 acres part of 110 acres of the variety "Gluclub." It had been planted during the first week in May with 50 lbs. of seed treated with copper carbonate. There

was but little weed growth or admixture, and the crop was also fairly free of disease, only a trace of Take-all and Flag Smut being observed.

The crop of Messrs Chas. Smith and Sons was awarded second place. It was also of the variety "Gluclub." It was planted during the early part of May with 48 lbs. per acre of graded seed treated with copper carbonate for the prevention of smut, 88 lbs. of superphosphate were applied per acre. The crop was very free of admixture but black oats and mustard were conspicuous. Flag Smut was noticed and Take-all occurred in patches.

The rainfalls as recorded at the nearest official recording stations to the competitors were:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Shackleton	118	...	74	49	114	104	433	200	128	22	1,001	2	28	1,272
Babakin	26	...	25	17	129	56	403	171	69	30	858	7	2	935
Belka ...	25	6	87	25	143	80	330	133	87	27	800	...	63	1,009
Yarding	67	...	47	8	103	79	333	142	111	23	791	3	67	986
Ardath ...	63	...	54	13	119	90	381	163	117	39	909	1	27	1,067
Korbel ...	60	...	102	53	110	88	277	242	90	23	830	...	55	1 100

The methods of cultivation adopted by the various competitors are summarised hereunder:—

TABLE 24.

BRUCE ROCK DISTRICT CROP COMPETITION.

Competitor ...	Strange, P.H.	Smith, C. & Sons.	Faulkner, D. H.	Mann, R.
Years cropped ...	Three	Ten at least	Five	Four
Timber	Salmon Gum and Gimlet	Salmon Gum and Gimlet	Salmon Gum, Gimlet, little Jam and scrub	Salmon Gum, Gimlet and Mallee
Ploughed	July	July	July and August	End of July
Type of plough ...	Sundercut	Mouldboard	Mouldboard	Mouldboard
Depth	3½in. to 4in.	3in.	3in.	4in.
Condition of land at time of ploughing	Good	Good	Good	Good
Other cultivations	Disc cultivated in Sept. Planted with a Combine	Cultivated with Sundercut in August, again in Sept. Drilled with a Combine	Disced in October and Duckfoot scarified prior to seeding	Cultivated with scarifier in Sept.
Variety ...	Gluclub	Gluclub	Gluclub	Gluclub
Planted	1st week in May	End of May	Third week in April	Third and fourth week in April
Rate of seed ...	50lbs.	48lbs.	45lbs.	60lbs.
Graded	Yes	Yes	Recleaned	Recleaned
Treated	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of super. ...	96lbs.	88lbs.	70lbs.	110lbs.
Disease	Traces of Take-all and Flag Smut	Flag Smut	Trace of Take-all also Flag Smut	A little Septoria

BRUCE ROCK DISTRICT CROP COMPETITION—*continued.*

Competitor ...	Foss, I and J. S.	Harling, H. H.	Starcevitch, J.
Years cropped ...	Second	Fourteen	Four at least
Timber	Mallee, scrub, broom and Tea-tree	Salmon and Gimlet	Salmon Gum, Gimlet, and little Mallee
Ploughed	August	July	August
Type of plough ...	State Disc	Mouldboard and disc	Mouldboard
Depth	4in.	4in.	4in.
Condition of land at time of ploughing	Good	Good	Setting hard
Other Cultivations...	Planted with a Combine	Cultivated during August and again in September. Drilled with a Combine	Disc cultivated in March and springtyne cultivated before seeding
Variety	Nabawa	Nabawa	Nabawa
Planted	2nd week May	20th 25th May	May
Rate of seed ...	55lbs.	45lbs.	60lbs.
Graded	Yes	Yes	Yes
Treated	No	No	Dry pickled
Rate of super. ...	140lbs.	100lbs.	80lbs.
Disease	Slight trace of Take-all and Smut	Ball Smut and Take-all	A little Take-all

DOODLAKINE-BAANDEE AGRICULTURAL SOCIETY.

Six competitors submitted their crops for inspection in the competition conducted by the above Society; the awards being as hereunder:—

TABLE 25.

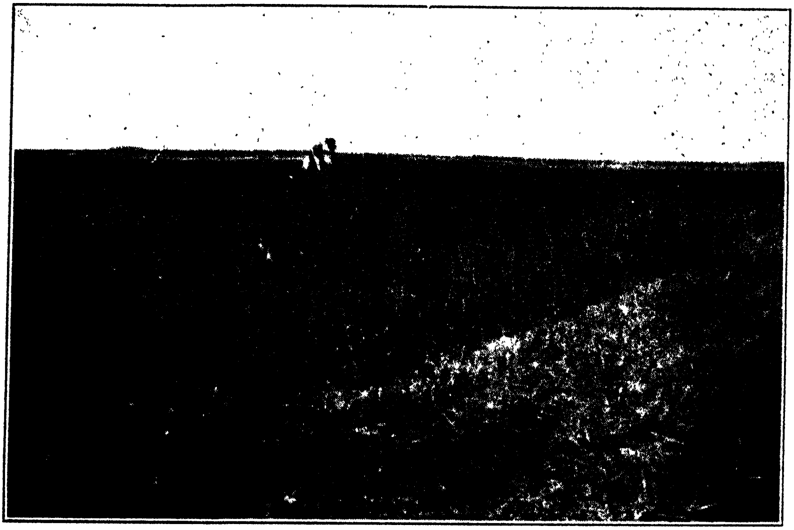
DOODLAKINE BAANDEE AGRICULTURAL SOCIETY.

ZONE 5.

Judge: I. Thomas, Superintendent of Wheat Farms.

Name.	Address.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Prowse, A. E. C.	Doodlakine ...	Gluyas Early	24	18	12	14	9	77
Barton & Son	Doodlakine ...	Gluyas Late	25	17	13	13	8	76
Mableson, H. H.	Baandee ...	Nabawa ...	20	19	13	13	9	74
Prowse Bros. ...	Doodlakine ...	Nabawa ...	20	19	14	13	7	73
Spillman, D. J.	Baandee ...	Nabawa ...	18	19	14	13	8	72
Spillman, J. W.	Baandee ...	Nabawa ...	16	19	14	13	9	71

Mr. A. E. C. Prowse was awarded first prize with a selected portion from 150 acres of "Gluyas Early" which was planted towards the end of May. The seed had been treated with copper carbonate and 90 lbs. of superphosphate applied per acre. It was very even in growth, contained but little admixture or weed growth, and the disease present was limited to traces of Ball Smut and Take-all.



Messrs. Barton & Sons' "Late Gluyas."
2nd Prize, Doodlakine-Baandee. Yield—25 bushels per acre.

A. E. C. Prowse's "Gluyas Early."

1st Prize, Doodlakine-Baandee. Yield—24 bushels per acre.

Messrs Barton and Sons secured second place with a crop of "Gluyas Late," calculated to yield 25 bushels per acre. Except for odd heads of barley it was fairly free of admixture, while the disease consisted of traces of Flag Smut and Take-all only.

The rainfalls as officially recorded at Doodlakine and Baandee were:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains.						Total.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
Doodlakine	24	...	70	6	94	76	273	101	73	13	630	...	97	807
Baandee	9	...	87	9	87	53	244	165	49	...	...	...	...	...

The methods of cultivation adopted by the various competitors are summarised hereunder:—

TABLE 26.

DOODLAKINE BAANDEE DISTRICT CROP COMPETITION.

Competitor	Prowse, A. E. C.	Barton & Son.	Mableson, H. H.	Prowse Bros.	Spillman, D. J.	Spillman, J. W.
Years cropped	Three	Ten at least	Nine	Three	First year	Three or four
Timber ...	Salmon Gum, Gimlet and little Mallee	Gimlet, Salmon Gum and Tea-tree	Salmon Gum and Gimlet	Most Mallee	Light land, patches Gimlet, Salmon and White Gum	Tamma thicket
Ploughed ...	July and Aug.	June	June and July	July	August	August.
Type of plough	Mouldboard	Disc	Springtyne cultivator	Disc	Sundercut	Sundercut
Depth ...	3½in.	4in.	2in.	3½in.	3in.–4in.	4in.
Condition of land at time of ploughing	Good	Inclined to be wet	Inclined to be hard	Good	Good	Good
Other cultivations	Springtyne cultivated in August and planted with a Combine	Cultivated after ploughing, again during Sept. and first week in Feb. with scarifier. Cultivated and harrowed prior drilling	Cultivated with Duck-foot machine in Sept. Springtyne cultivated prior to drilling	Springtyne cultivated in August and planted with a Combine	Disced with a Sundercut in Apl. Planted with Combine	Cultivated prior to drilling
Variety ..	Gluyas Early	Gluyas Late	Nabawa	Nabawa	Nabawa	Nabawa
Planted ...	End of May	First week in April	Last week in April	Last week in April	Last week in April	Last week in April
Rate of seed	45lbs.	45lbs.	45lbs.	45lbs.	60lbs.	50lbs.
Graded ...	Yes	Yes	Yes	Yes	Yes	Recleaned
Treated ...	Dry pickled	Dry pickled	No	Dry pickled	Dry pickled	Dry pickled
Rate of super.	90lbs.	80lbs. 90lbs.	90lbs.	90lbs.	90lbs.–100lbs.	90lbs.
Disease ...	Trace Ball and Flag Smuts; also Take-all	Flag Smut and trace of Take-all	Trace of Ball Smut	...	Septoria in patches	...

MERREDIN AGRICULTURAL SOCIETY.

In this Society's competition nine crops were inspected. The awards were made as follows:—

TABLE 27.

MERREDIN AGRICULTURAL SOCIETY.

ZONE 5.

Judge: I. Thomas, Superintendent of Wheat Farms.

Name.	Address.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Smallacombe, H. A.	Merredin ...	Canberra ...	22	17	14	14	7	74
Maughan Bros.	Nukarni ...	Merredin ...	19	19	13	13	8	72
Hughes, J. ...	Merredin ...	Canberra ...	20	19	12	11	8	70
Priestly, J. ...	Merredin ...	Nabawa ...	20	16	13	14	7	70
Clothier, J. ...	Merredin ...	Nabawa ...	19	16	13	13	8	69
Hawke, W. L.	...	Gluyas Early	16	19	12	13	8	68
Dumsday, L. ...	Goomarin ...	Nabawa ...	16	17	14	14	7	68
Cummings, J. J.	Korbel ...	Merredin ...	19	16	13	12	7	67
Teasdale, H. W.	Korbel ...	Merredin ...	16	16	13	14	7	66

Mr. H. A. Smallacombe secured first place with 50 acres of "Canberra," calculated to yield 22 bushels per acre. This crop, which was planted during the first week in June at the rate of 60 lbs. per acre of seed treated with copper carbonate, and to which was applied 90 lbs. per acre of Superphosphate, was, with the exception of a few scattered wild oats, free of weeds. It was also fairly free of admixture and disease, a trace of Flag Smut only, being noticed. The crop was, however, somewhat uneven in height and stooling.

Messrs Maughan Bros.' crop of "Merredin" was awarded second prize. This was part of 90 acres planted during the middle of May at the rate of 45 lbs. per acre of seed with an application of 85 lbs. per acre of superphosphate. Although free of weeds, traces of Ball Smut and Flag Smut were present. A few heads of another wheat variety were noticed. Except in small patches the crop was even in height and stooling indicating uniform preparation.

The rainfalls as officially recorded at the recording stations nearest the different competitors are set out below:—

......	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Merredin	48	...	117	77	94	125	221	160	64	27	691	...	97	1,030
Nukarni	17	...	96	84	119	78	202	191	56	28	674	4	46	921
Goomarin	84	...	51	80	121	83	182	163	79	18	646	12	35	908
Korbel ...	60	...	102	53	110	88	277	242	90	23	830	...	55	1,100

The cultural methods of the various competitors are tabulated hereunder:—

TABLE 28.

MERREDIN DISTRICT CROP COMPETITION.

ZONE 5.

Competitor...	Smallacombe, H. A.	Maughan Bros.	Hughes, J.	Priestley, J.	Clothier, J.
Years cropped	At least five	First	Three crops	At least twelve	Eight
Timber ...	Salmon and Gimlet to Mallee and White Gum	Salmon and Gimlet	Salmon Gum, Gimlet and Tea-tree	Salmon and Gimlet	Salmon Gum, Gimlet, little White Gum and scrub
Ploughed ...	August	June	May June	June July	June and early July
Type of plough	Sundercut	Sundercut	Disc and Mouldboard	Disc	Sundercut
Depth ...	3in.-4in.	3in.	4½in.	4in.	2½in.
Condition of land at time of ploughing	On the hard side in patches	Excellent	Good	On the wet side	Getting hard
Other cultivations	Disc cultivated in October. Springtyned prior to seeding	Springtyne cultivated during October and November	Springtyned July, August, and twice in September and again ahead of the Combine	Springtyned beginning of September. Rolled in September and harrowed. Cultivated with Tandem disc in March and Springtyned before seeding	Cultivated with Springtyne in Sept., part disc and part cross-cultivated in March. Planted with Combine
Variety ...	Canberra	Merredin	Canberra	Nabawa	Merredin
Planted ...	First week in June	15th May	5th May	Second week in April	Third week in May
Rate of seed..	60lbs.	45lbs.	52lbs.	50lbs	45lbs.
Graded ...	No. Recleaned only	Yes	Yes	No	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of super.	90lbs.	85lbs.	140lbs. 150lbs.	80lbs.-90lbs.	90lbs.
Disease ...	A little Flag Smut	Traces of Flying Fall and Flag Smuts	Flag and Fall Smuts; trace of Take-all	Take-all	Take-all

TABLE 28, ZONE 5—*continued.*

MERREDIN DISTRICT CROP COMPETITION—*continued*

Competitor ...	Hawkes, W. L.	Dumsday, L.	Cummings, J. J.	Teesdale, H. W.
Years cropped	At least five	...	At least four	Eight or nine
Timber ...	Red Morrell	Gimlet and Tea-tree	Salmon Gum and Gimlet	Mainly Gimlet, little Salmon Gum
Ploughed ...	July	July	Last week in May and first week in June	August–September
Type of plough	Sundercut	Disc	Disc	Disc
Depth ...	3in.	3½in.	3½in.	3in.
Condition of land at time of ploughing	Good	...	Good	Hard
Other cultivations	Springtyned in March. Planted with Combine	Scarified in August; harrowed in November	Cultivated with a Duckfoot scarifier second week in August. Disc harrowed fourth week in September. Harrowed in March	Cultivated with a Duckfoot machine in September, during summer, and again prior to seeding with a Combine
Variety ...	Gluyas Early	Nabawa	Merredin	Merredin
Planted ...	...	19th and 20th April	5th May	3rd week in May
Rate of seed	45lbs.	40lbs.	55lbs.	45lbs.
Graded ...	No	Yes	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	No
Rate of super.	90lbs	112lbs.	80lbs.	90lbs.
Disease ...	Ball Smut and a trace of Flag Smut	Take-all,	Traces of Ball and Flag Smuts	Take-all in patches and Flag Smut scattered

Mr. J. Deane Hammond of Kellerberrin was the only competitor in this zone who entered direct with the Royal Agricultural Society. The points awarded were:—

Name.	Address.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Admixture. 15 points.	Freedom from Disease. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Hammond, J. D.	Kellerberrin ...	Carrabin ...	26	19	14	14	8	81

The crop submitted by this competitor was 50 acres of "Carrabin" being part of 60 acres of the same variety.

Except for a little capeweed, it was very free of weeds, and little or no admixture or disease was noticed. The growth was a little irregular but, being well grown and dense, the crop gave promise of high yields in large portions, although in others, also well grown, it had not stooled so well.

This crop was planted in May at the rate of 60 lbs. per acre of graded seed, treated with copper carbonate, 100 lbs. per acre of superphosphate being applied.

The monthly rainfall as officially recorded at Kellerberrin was:—

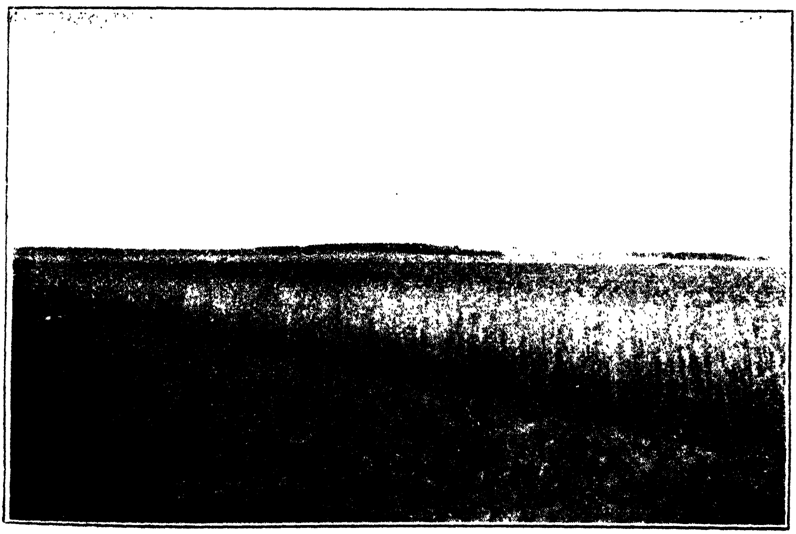
——	Jan.	Feb.	Mar.	Apl.	Useful Rains. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Kellerberrin	58	8	82	21	174	95	423	143	107	36	978	2	67	1,216

The details of cultivation are as set out hereunder:—

TABLE 29.

ROYAL CROP COMPETITION.

Competitor	J. Deane Hammond.
Years cropped	First
Timber	Mainly Gimlet : little Jam, York Gum
Ploughed	July—August
Type of plough	Mouldboard
Depth	$3\frac{1}{2}$in.
Condition of land at time of ploughing	Inclined to be dry
Other cultivations	Springtyne cultivated September. Planted with a Combine and harrowed immediately after
Variety	Carrabin
Planted	May
Rate of seed	60lbs.
Graded	Yes
Treated	Dry pickled
Rate of super.	100lbs
Disease	



Mr. J. Dean-Hammond's 50 acres "Carrabin."

Winner—Championship Prize, Zone 5. Yield—26 bushels per acre.

ZONE 6.

Judge: A. S. WILD, B.Sc. (Agric.), Agricultural Adviser.

No district Agricultural Society located in this Zone conducted crop competitions, the three entries being received by the Royal Agricultural Society.

The points awarded to the two crops submitted to the Judge for inspection are as hereunder:—

TABLE 30.

ROYAL AGRICULTURAL SOCIETY.

ZONE 6.

Judge: A. S. Wild, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Admixture. 15 points.	Freedom from Disease. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Richards, T. ...	South Caroling	Nabawa ...	25	18	14	14	8	79
Smith, H. D....	Beverley ...	Nabawa ...	24	17	14	14	8	77

Both crops were of the variety "Nabawa," that of Mr. Richards was calculated to yield 25 bushels per acre, whilst Mr. Smith's was calculated to yield 24 bushels per acre.

Mr. Richard's crop was planted at the end of May at the rate of 45 lbs. of graded, pickled seed per acre, with an application of 130 lbs. of superphosphate per acre on land which had been ploughed the previous June. This crop contained a few mustard and canary grass plants and odd plants of drake. The disease was limited to traces of Flying Smut and Take-all.

Mr. Smith's crop was also planted at the end of May at the rate of 45 lbs. of seed per acre with an application of 70 lbs. of Superphosphate per acre. Although comparatively free from admixture, it lost points for weed growth.

The rainfalls as officially recorded at Beverley and South Caroling during during 1928 were:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Beverley	56	...	18	44	146	145	564	331	141	41	1,368	3	31	1,520
South Caroling	57	...	6	20	127	91	458	208	123	15	1,022	...	...	..

The details of the preparation of the land and of the cropping are as hereunder:—

TABLE 31.

ROYAL CROP COMPETITION.

ZONE 6.

Competitor	Richards, T.	Smith, H. D.
Years cropped	Cropped for 10 years	Third crop
Timber	Salmon Gum and Morrell	Jam and York Gum
Ploughed	End of June	End of August
Type of plough	Mouldboard	Mouldboard
Depth	4½in. to 5in.	4in.
Condition of land at time of ploughing	Good	Very good
Other cultivations	Springtyne cultivated twice in Spring and again twice in Autumn	Springtyne cultivated before seeding and Combine drilled
Variety	Nabawa	Nabawa
Planted	End of May	End of May
Rate of seed	45lbs.	45lbs.
Graded	Yes	Yes
Treated	Yes - Dry	Yes Formalin
Rate of super	130lbs.	70lbs.
Disease	Traces of flying Smut and Take-all	Trace Take-all

ZONE 7.

Judge: J. H. LANGFIELD, Manager, Experiment Farm, Merredin.

In this zone entries were received through the Kulin and Lake Grace Agricultural Societies.

KULIN AGRICULTURAL SOCIETY.

Nine crops were inspected in the competition of the above Society and all gave promise of good yields. The rainfall although below the average for the district was quite sufficient for the growing of good crops. The rainfall from the 1st January to 30th November, was 1303 points, and during the growing period, 1st May to 31st October, 997 points. The official rainfall as recorded at the Kulin Post Office was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year
					May.	June.	July	Aug.	Sept.	Oct.	Total.			
Kulin ...	108	3	16	155	149	89	365	223	100	71	997	24	49	1,352

The points awarded the various competitors are as follow:—

TABLE 32.

KULIN AGRICULTURAL SOCIETY.

ZONE 7.

Judge: J. H. Langfield, Manager Merredin Experimental Farm.

Competitor.	District.	Variety.	Estimated Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
F. S. Freebairn	Kulin ...	Queen Fan	26	19	14	14	8	81
Trotter, A. W.	Kulin ...	Hard Federation	26	18	14	14	8	80
Bowey, P. J....	Kulin ...	Ford ...	25	19	13	14	8	79
Roberts Bros....	Kulin ...	Hard Federation	22	19	14	14	8	77
Nichols, R. ...	Kulin ...	Nabawa ...	22	19	14	14	7	76
Evans, H. ...	Kulin ...	Queen Fan...	23	19	13	13	8	76
Johnston, H. ...	Kulin ...	Nabawa ...	23	18	14	13	7	75
Bowey, L. M. ...	Kulin ...	Merredin ...	20	19	14	14	8	75
Bowey & Baldock	Kulin ...	Nabawa ...	18	18	15	14	8	73

Mr. Freebairn secured first prize with a crop of "Queen Fan." It was fairly thick and well filled; the land had been well worked, this being reflected in the absence of weeds. It had been fed off with sheep until the end of July. There was very little disease or admixture.

Mr. Trotter's crop was Hard Federation, very well filled and when thrashed gave a nice bright sample of grain. It was very free from admixture or disease, and there were very few weeds.

Mr. P. J. Bowey's crop was the variety "Ford." It was fairly tall and well filled, but showed a fair amount of Flag Smut which, however, was the only disease noticed.

All the competitors dry-pickled their seed, and only in a few instances were traces of Ball Smut found. Ball Smut was noticed, however, to be rather prevalent in several crops that were not in the competition in spite of the fact that the seed had been treated with Copper Carbonate. In such cases, the failure is due, not to the inefficiency of the method itself, but rather to the methods of application. The efficiency of any method of treatment to prevent smut depends upon thoroughness; the success of the dry method necessitates the thorough dusting of the seed with copper carbonate powder. In many instances this fact is overlooked and the seed allowed to pass through the dusting chamber too quickly. Some farmers even consider that the mixing of the powder with the seed in the drill box is sufficient. This is a bad practice and one which it is wise to discontinue.

The methods of cultivation and other details are as follow:—

TABLE 33.

KULIN CROP COMPETITION.

ZONE 7.

Competitor ...	Freebairn, F. S.	Trotter, A. W.	Bowey, P. J.	Roberts Bros.	Nichols, R.
Years cropped	Four	Seven	Twelve	Six	Ten
Timber ...	Morrell and Salmon Gum	Jam and mixed forest	Salmon and Mallee	Salmon and Mallee	Salmon and Mallee
Ploughed ...	June	July	June	June	July
Type of plough	Mouldboard	Mouldboard	Duckfoot cultivator	Disc	Disc
Depth ...	4½in.	4in.	2½in.	3in.	4in.
Condition of land at time of ploughing	Good	Good	Good	Good	Good
Other cultivations	Cultivated and harrowed in August. Cultivated Sept. Harrowed Oct. Cultivated and harrowed in April	Cultivated Spring and before seeding	Cultivated in Spring only. Combined	Cultivated in Spring with disc and with Duckfoot before seeding	Cultivated Sept. Disc, cultivated Oct. Spring-tyne and before seeding
Variety ...	Queen Fan	Hard Federation	Ford	Hard Federation	Nabawa
Planted ...	10th May	Mid-May	1st May	End of May	End of April
Rate of seed	60lbs.	60lbs.	55lbs.	60lbs.	60lbs
Graded ...	Winnowed ...	Yes	Yes	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of super.	112lbs.	90lbs.	90lbs.	90lbs.	70lbs.
Disease ...	Trace of Take-all	Trace of Take-all	Flag Smut	Trace of Flying Smut	Immature ears

Competitor ...	Evans, H.	Johnston, H.	Bowey, L. M.	Bowey & Baldock.
Years cropped	Seven	Five	Eighteen	Three
Timber ...	Salmon and Gimlet	York Gum and Morrell	Salmon and Mallee	Salmon, Mallee and Morrell
Ploughed ...	July	August	July	June
Type of plough	Mouldboard	Mouldboard	Duckfoot Cultivator	Duckfoot Cultivator
Depth ...	4in.	4in.	2½in.	2½in.
Condition of land at time of ploughing	Good	Good	Good	Good
Other cultivations	Cultivated September. Disc Spring-tyne March	Cultivated in Spring only Combined	Duckfoot in September and before seeding	Duckfoot in September and Combined
Variety ...	Queen Fan	Nabawa	Merredin	Nabawa
Planted ...	1st May	May	Mid-May	End of May
Rate of seed ...	48lbs.	43lbs.	55lbs.	50lbs.
Graded ...	No	Winnowed	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of super.	90lbs.	90lbs.	90lbs.	75lbs.
Disease ...	Traces of Ball Smut and Flying Smut	Trace of Ball Smut	Trace of Flag Smut	...

LAKE GRACE AGRICULTURAL SOCIETY.

This is the first occasion on which this district has joined in the cropping competitions, and the Society must be congratulated on the very fine crops exhibited. Twelve crops were inspected and the general average was very creditable, the competing crops promising good yields, as also did the general average of the crops seen throughout the district.

The rainfall from the 1st January to 31st October was 1024 points, and over the growing period, viz., 1st May to 31st October, 921 points. This, although below the average for the district, must be considered satisfactory.

The official rainfall as recorded at Lake Grace during the year was as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Lake Grace	111	...	2	100	126	91	313	263	91	37	921	2	26	1,162

The points awarded to the various competitors are as follow:—

TABLE 34.

LAKE GRACE AGRICULTURAL SOCIETY.

ZONE 7.

Judge: J. H. Langfield, Manager Merredin Experiment Farm.

Competitor.	District.	Variety.	Estimated Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Stephens, F. ...	Lake Grace ...	Caliph ...	31	19	14	14	9	87
Bishop, H. ...	Lake Grace ...	Nabawa ...	25	19	14	14	8	80
Woodbury ...	Lake Grace ...	Yandilla King	25	18	14	14	8	79
Collinson & Fleay	Lake Grace ...	Gluyas Early	22	19	14	14	9	78
Harvey, J. F....	Lake Grace ...	Gluyas Late	24	17	13	14	8	76
Lay, — ...	Lake Grace ...	Nabawa ...	25	18	12	13	7	75
Coad, H. J. ...	Lake Grace ...	Baroota Wonder Early	23	18	14	13	7	75
Fry, E. ...	Lake Grace ...	Gluyas Early	22	18	13	14	8	75
Griffin, C. ...	Lake Grace ...	Merredin ...	21	18	15	13	7	74
Witham & Sons	North Biddy...	Gluyas Early	18	19	14	14	8	73
Darby, A. H.	Lake Grace ...	Gluyas Early	21	16	13	14	7	71
Lucas, — ...	Lake Grace ...	Yandilla King	19	17	13	14	7	70

The winning crop was 50 acres of "Caliph," entered by Mr. F. Stephens. It was very thick and even, very free of weeds, disease and admixture, and showed the result of careful farming. The land had been ploughed early in July, twice cultivated in spring and harrowed, and was worked with a Sundercut before seeding.

Mr. Bishop's crop was "Nabawa," the land being ploughed in early August with a disc implement (Sundercut) cultivated early in September and skim ploughed and harrowed at the end of September. The crop was very free from weeds, disease and admixture. The heads were well filled and the grain well developed. The only outstanding disease noticed in the crops in this district was Take-all. Little or no Flag Smut and very little

Ball Smut was encountered. In this instance the prevalence of Take-all must be attributed to the pioneering methods which are usually adopted in new districts, viz., continuous wheat for several seasons. This method of farming encourages the disease, and once it is firmly established it is very difficult to control, Farmers are realising the disabilities of wheat growing alone, and are making preparations for running sheep and growing oats. This will enable them to work in a definite rotation and should help considerably in controlling the disease.

The cultural methods adopted by the various competitors are as follow:—

TABLE 35.

LAKE GRACE CROP COMPETITION.

ZONE 7.

Competitor	F. Stephens.	Bishop, H.	Woodburn,	Collinson & Fleay	Harvey, J. F.	Lay
Years cropped	Nine	Four	Five	First crop	Seven	Three
Timber ...	Salmon and Yorrell	Gimlet	Forest and Blackbutt	Blackbutt and Morrell	Blackbutt and Morrell	Gimlet
Ploughed ...	Early July	Early August	Late June	August	August	July
Type of Plough	Disc	Disc	Disc	Disc	Mouldboard	Disc
Depth . .	3½in.	3½in.	3½in.	3in.	3½in.	3in.
Condition of land at time of ploughing	Good	Good	Good	Good	Wet	Good
Other cultivations	Twice in Spring and harrowed Sundercut before seeding. Sown with disc drill	September, and skim-ploughed and harrowed end of Sept. Sown with Combine	Springtyne in July Sept. and Oct. and again before seeding. Sown with disc drill	...	Cultivated in Spring. Sown with Sunder-seeder	Twice Sept. and sundercut before seeding.
Variety ...	Caliph	Nabawa	Yandilla King	Gluyas Late	Gluyas Early	Nabawa
Planted ...	May	May	Mid-April	Mid May	May	May
Rate of seed	50lbs.	45lbs	50lbs.	45lbs.	45lbs.	50lbs.
Graded ...	Yes	Yes	No	No	No	Re-winnowed
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	Formalin	Dry pickled
Rate of super.	120lbs.	120lbs	86lbs.	60lbs.	80lbs.	75lbs.
Disease ...	Trace of Flying Smut	...	Trace of Flying Smut	Ball Smut	Take-all	Take-all

TABLE 35, ZONE 7—*continued.*

LAKE GRACE CROP COMPETITION—*continued.*

Competitor	Coad, H. J.	Fry, E.	Griffin, C.	Witham & Sons	Darby, A. H.	Lucas, —
Years cropped	Five	...	Six	...	Fifteen	Seven
Timber ...	Morrell and Gimlet	Salmon and Morrell	Salmon Gum	Salmon and Gimlet	Salmon and Mallee	Salmon and Gimlet
Ploughed	July	July	June and July	...	July	Late July
Type of plough	Disc	Disc	Mouldboard	...	Mouldboard	Disc
Depth ...	3½in.	3in.	4in.	...	4in.	3½in.
Condition of land at time of ploughing	Wet	Good	Good	...	Wet	Wet
Other cultivations	Springtyned in Spring and sown with Combine	Twice in Spring with Sundercut	Springtyned in Spring and again before seeding	...	Disced in Sept. and Oct. Springtyned and harrowed before seeding. Sown with Combine	Sundercut in in Spring. Sown with Sunderseeder
Variety ..	Baroota Wonder Early	Gluyas Early	Merredin	Gluyas Early	Gluyas Early	Yandilla King
Planted ...	Mid-April	May	End May	...	1st May	End April
Rate of seed	45lbs.	45lbs.	60lbs.	...	45lbs.	50lbs.
Graded ...	Yes	Yes	No	...	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Formalin	..	Dry pickled	Dry pickled
Rate of super.	75lbs.	90lbs.	112lbs.	...	112lbs.	120lbs
Disease ...	Trace of Flying Smut	Ball Smut	Trace of Ball Smut	...	Take-all	Take-all

ZONE 8.

Judge: A. S. WILD, B.Sc. (Agric.), Agricultural Adviser.

Three competitors in Zone 8 who submitted their crops for inspection entered direct with the Royal Agricultural Society. The remaining ten were entered in the Gnowangerup Agricultural Society's Crop Competition.

GNOWANGERUP DISTRICT AGRICULTURAL SOCIETY

All the ten entrants in the competition of the above Society submitted their crops for inspection:—

The awards made are as hereunder:—

TABLE 36.

GNOWANGERUP AGRICULTURAL SOCIETY.

ZONE 8.

Judge: A. S. Wild, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Parkinson, A. W.	Gnowangerup	Yandilla King	40	18	14	13	9	94
Davis, N. ...	Gnowangerup	Nabawa ...	39	18	14	14	8	93
Johnston, Alfred	Gnowangerup	Bena ...	36	18	14	14	9	91
McDonald, John	Gnowangerup	Nabawa ...	36	19	14	13	9	91
Milne, Malcolm	Borden ...	Nabawa ...	32	19	14	14	8	87
Ball, J. L. ...	Gnowangerup	Bena ...	31	18	14	13	8	84
Whyatt, C. A.	Pallinup ...	Drof ...	28	18	14	12	8	80
Murray, Gordon	Borden ...	Nabawa ...	26	18	14	13	8	79
Wright, E. H.	Pallinup ...	Bena ...	26	17	13	14	8	78
White, A. J....	Pallinup ...	Walkers ...	24	18	14	13	8	77

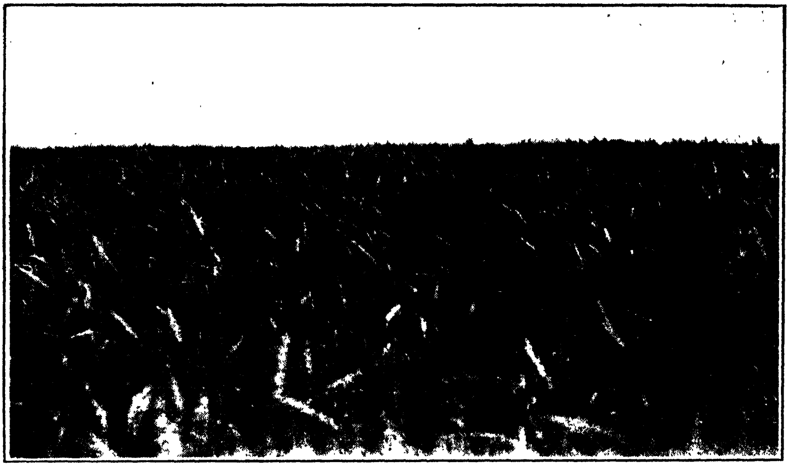
Mr. A. W. Parkinson again secured first place with the variety "Yandilla King." The continued success of this competitor with this late ariety is worthy of special mention.

In spite of the seasonal rains cutting off short, the 50 acres inspected produced a calculated yield of 40 bushels. Although slightly "tipped" in places, the heads were well filled. Except for a few thistles, the crop was comparatively free of weeds and, with the exception of a little Flying Smut, of disease. Portion of the 50 acres had been planted with clean pedigreed seed from the Department's Experiment farms. This was free from admixture, but the balance, which had been planted with old seed had throughout, a proportion of barley, and heads of strange wheat varieties. The land had been fallowed during June and July of the previous year and had received subsequent treatment as shown in the accompanying table of cultural details. During the fallowing period and subsequently, sheep had been depastured on the land to assist in checking weed growth. This crop was sown during the 2nd and 3rd weeks in May at the rate of 45 lbs. of graded seed per acre with an application of 112 lbs. of superphosphate per acre.

Mr. N. L. P. Davis is to be congratulated on having obtained a calculated yield of 39 bushels per acre with the variety "Nabawa." The crop was well stooled and the heads well filled and free from disease. Points were lost for weed growth but, except for odd heads of barley, there was very little admixture. The seed had been sown at the rate of 45 lbs. per acre and the superphosphate applied at the rate of 200 lbs. per acre.

Both Mr. A. Johnston and Mr. J. McDonald obtained the very creditable calculated yield of 36 bushels per acre, the former with the variety "Bena" and the latter with the variety "Nabawa."

As was the case during 1927 all the crops entered through the Gnowangerup Society were of a high standard. It is to be regretted that five out of the ten competitors are still pickling their seed by the formalin method instead of by the more up to date and convenient dry method with copper carbonate.



A. W. Parkinson's 50 acres "Yandilla King."
Winner—Championship Prize, No. 8 Zone;
Royal Agricultural Society's Special Prize.
Yield—40 bushels per acre.

N. L. P. Davis' 50 acres "Nabawa."
Yield—39 bushels per acre.

Farley Photos., Gnowangerup.

J. McDonald's 50 acres "Nabawa."
Yield—36 bushels per acre.
Farley Photos., Gnowangerup.

A. Johnston's 50 acres "Bena."
Yield—36 bushels per acre.
Photo. by R. Farley, Gnowangerup.

It was fortunate for this district that the rainfall conditions of 1928 which affected so many crops throughout the remainder of the wheat belt did not seriously depreciate the yields in this zone.

The rainfalls as officially recorded at Gnowangerup and Borden during the year were:—

...	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for year.
Gnowangerup	207	...	5	244	101	145	258	219	199	60	982	13	13	1,464
Borden ...	195	...	...	104	82	100	212	158	208	50	810	...	.	...

The methods of cultivation and other details are summarised below:—

TABLE 37.

GNOWANGERUP DISTRICT CROP COMPETITION.

ZONE 8.

Competitor	Parkinson A. W.	Davis, N.	Johnston, Alfred.	McDonald, John.	Milne, Malcolm.
Years cropped	Fifth crop	Fifth crop	Third crop	Old land	Old land, first crop for six years
Timber ...	York Gum, Jam, and Morrel, with scattered Manna Gum	Morrel and York Gum	York Gum, Manna Gum, Poot, Sheoak in one corner	York Gum with some Morrel and Manna Gum	Jam, York Gum and Morrel
Ploughed ...	June and July	July	August	Late July and early August	July
Type of plough	Mouldboard	Mouldboard	Mouldboard	Mouldboard	Disc
Depth ...	3½in. to 4in.	3½in. to 4in.	2½in. to 3in.	3in. to 3½in.	2½in. to 3½in.
Condition of land at time of ploughing	Fair	Good	Good	Fairly good	Hard
Other cultivations	Springtyne cultivated early August. Disced 2½in. deep in September. Portion skim ploughed with Mouldboard in October, whole Springtyne cultivated in October and again in Nov. Springtyne cultivated in March and again twice before drilling. Light drag harrows behind drill	Springtyne cultivated in September, in October, twice in January and once in April after rain in each case. Drilled with Combine with light drag harrows	Disced 2in. deep in Spring. Harrowed twice in Spring. Duckfoot cultivated and harrowed before seeding. Harrowed after drill	Springtyne cultivated and harrowed in Sept. Skim ploughed 2in. deep in January. Springtyne cultivated in April. Drilled with Combine with light drag harrows behind	Disced 2in. deep about late August and early July. Springtyne cultivated in October. Skim ploughed in April. Drilled with Combine
Variety ...	Yandilla King	Nabawa	Bena	Nabawa	Nabawa
Planted ...	2nd to 3rd week in May	First week in June	End of May	5th to 9th June	1st and Second week in June
Rate of seed	45lbs.	45lbs.	60lbs.	52lbs.	45lbs
Graded ...	Yes	Yes	Yes	Yes	Yes
Treated ...	Pickled with formalin	Dry pickled	Pickled with formalin	Dry pickled	Dry pickled
Rate of super.	112lbs.	200lbs.	73lbs.	96lbs.	112lbs.
Disease ...	Trace of Flying Smut	...	Trace of Take-all	...	..

TABLE 37, ZONE 8—*continued*.

GNOWANGERUP DISTRICT CROP COMPETITION—*continued*.

Competitor	Ball, J. L.	Wyatt, C. A.	Murray, Gordon.	Wright, E. H.	White, A. J.
Years cropped	First crop	Third crop	Old land	Fourth crop	Second crop
Timber ..	Jam and Morrel	Poot and York Gum	York Gum and Poot	York, Gum, Poot and Manna Gum	Morrel and York Gum
Ploughed .	Early August	July	July and August	August	August and September
Type of plough	Mouldboard	Mouldboard	Disc	Mouldboard	Mouldboard
Depth ..	3in.	4in.	2½in. to 3in.	3½in.	4in to 5in.
Condition of land at time of ploughing	Good	Good	Good and bad	Good	Fair
Other cultivations	Disced and harrowed in Spring. Drilled with Combine with light drag harrows	Twice harrowed and then skimploughed with Mouldboard in Spring. Skim ploughed twice in April. Harrowed after drilling	Re-disced 2in. deep in December. Springtyne cultivated in February and again in April. Drilled with Combine	Disced 2in. deep in October. Springtyne cultivated beginning of May and drilled with a Combine with light drag harrows	Springtyne cultivated in November Drilled with Combine
Variety ...	Bena	Drof	Nabawa	Bena	Walker's
Planted ...	Middle of May	13th May	First week in June	21st May	First week in May
Rate of seed	47lbs.	45lbs.	52lbs.	60lbs.	50lbs
Graded ...	No	Yes	Yes	Yes	Yes
Treated .	Pickled with formalin	Pickled with formalin	Dry pickled	Pickled with formalin	Dry pickled
Rate of super.	85lbs.	85lbs.	96lbs.	85lbs.	80lbs.
Disease ..	...	Trace of Septoria	Trace of Flying Smut	Trace of Takeall	...

ROYAL AGRICULTURAL SOCIETY.

Five entries in Zone 8 were received direct through the Royal Agricultural Society. Of these three submitted their crops for inspection.

The points awarded for these crops are as hereunder:-

TABLE 38.

THE ROYAL AGRICULTURAL SOCIETY.

ZONE 8.

Judge: A. S. Wild, Agricultural Adviser.

Name.	District.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Stone, J. D. ...	Borden ...	Nabawa ...	31	18	14	14	8	85
Wilson, A. F....	Dumbleyung...	Yandilla King	32	18	14	13	8	85
Clifford, M. (Estate of)	Gillimanning...	Nabawa ...	24	18	14	14	9	79

The rainfalls as recorded at Borden, Dumbleyung and Wickepin (the nearest recording station to Gillimanning) were:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
Borden ...	195	...	...	104	82	100	212	158	208	50	810	...	...	..
Dumbleyung	85	...	13	153	152	148	446	312	174	76	1,308	6	26	1,591
Wickepin	81	...	16	134	143	108	482	375	161	79	1,348	1	26	1,606

The details of the cropping are as hereunder:—

TABLE 39.

ROYAL CROP COMPETITION.

ZONE 8.

Competitor ...	Stone, J.	Wilson, A. F.	Clifford, M. (Estate of).
Years cropped ...	Old land	Old land	5 crops
Timber	Morrel and York Gum with some Jam	Jam, Salmon and York Gum	York, Jam and Manna Gum
Ploughed	Mid-August	...	July
Type of plough ...	Mouldboard	Mouldboard	Mouldboard
Depth	4in.	2in.	4½in.
Condition of land at time of ploughing	Good and bad	Good but dry	Good and bad
Other cultivations...	Springtyne cultivated three times in Spring and before seeding. Duckfoot cultivated before seeding	Harrowed after plough. Scarified and then harrowed about October. Scarified again and left till Autumn when Springtyne cultivated with harrows behind. Drilled with Combine and harrows	Springtyne cultivated in Spring, again in Autumn and again prior to seeding
Variety	Nabawa	Yandilla King	Nabawa
Planted	End of May	End of May	Third week, May
Rate of seed ...	58lbs.	60lbs.	72lbs.
Graded	Yes	Yes	Yes
Treated	Yes; dry	Yes; dry	Yes; dry
Rate of super. ...	96lbs.	90lbs.	120lbs.
Disease	Trace of Flying Smut	Trace of Take-all and trace of Flying Smut	Trace of Take-all

ROYAL AGRICULTURAL SOCIETY ZONE CHAMPIONSHIP AWARDS.

The entrants for these championship prizes are the first and second prize winners of the district competitions, and also the competitors who enter direct with the Royal Agricultural Society.

The competitors in the different zones and the total points allotted are shown in the table hereunder:—

REPRESENTATIVES FROM DISTRICT AGRICULTURAL SOCIETYS' COMPETITION.

Competitor.	Society.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
ZONE 1—								
Forrester, J. K.	Royal ...	Nabawa ..	35	16	14	13	9	87
Hebiton, J. K.	Royal ...	Merredin ..	30	16	13	13	9	81
ZONE 2—								
Honner, R. J. & Sons	Dalwallinu ..	Gluyas Early	25	16	14	13	9	77
Porter, F. A.	Royal ...	Nabawa ...	21	16	14	12	9	72
Meadowcroft Bros	Geraldton ...	Toby's Tusk	20	16	14	12	9	71
Locke, F. C.	Dalwallinu ...	Ford ...	20	15	14	13	7	69
ZONE 3—								
Bryan, P. A.	Wongan Hills	Nabawa ...	29	18	14	13	8	82
Sawyer, T. G.	Goomalling ...	Nabawa ..	30	18	12	13	8	81
Slater, W. G.	Wongan Hills	Nabawa ...	27	18	13	13	9	80
Cosh, E. C. ...	Dowerin ...	Merredin ...	24	19	12	14	9	78
Hughes, J. R.	Dowerin ...	Nabawa ..	26	17	12	14	8	77
Whittingham, T. M.	Wyalkatchem	Merredin ..	22	18	14	14	9	77
McKay, N....	Wyalkatchem	Merredin ...	23	18	14	13	8	76
French, E. .	Goomalling ..	Nabawa ...	20	17	14	13	8	72
ZONE 4								
Young, G. T.	Nungarin ...	Gluyas Early	24	19	14	15	8	80
Creagh Bros.	Nungarin ...	Nabawa ...	22	18	14	14	9	77
Dunkley, G. A.	Mt. Marshall	Gluyas Early	22	19	13	14	9	77
Payne, H. ...	Nungarin ...	Merredin ...	22	19	14	12	8	75
Reynolds, A. G.	Royal ...	Gluyas Early	17	20	14	14	9	74
Richardson, J.	Royal ...	Nabawa ...	17	19	14	11	9	70
Hopwood, B. W. G	Mt. Marshall	Gluyas Early	17	18	14	12	8	69
ZONE 5								
Deane-Hammond, J.	Royal ...	Carrabin ...	26	19	14	14	8	81
Strange, P. A.	Bruce Rock	Gluclub ...	25	19	13	14	8	79
Smith, C. & Sons	Bruce Rock	Gluclub ...	25	18	13	14	8	78
Prowse, A. E. C.	Doodlakine-Baandee	Gluyas Early	24	18	12	14	9	77
Barton & Sons	Doodlakine-Baandee	Gluyas Late	25	17	13	13	8	76
Buller & Black	Bruce Rock	Nabawa ...	23	18	14	13	8	76
Mann, R. ...	Bruce Rock	Gluclub ...	23	18	14	13	8	76
Smallacombe, H. A.	Merredin ...	Canberra ...	22	17	14	14	7	74
Maughan Bros.	Merredin ...	Merredin ..	19	19	13	13	8	72
ZONE 6—								
Richards, T.	Royal ...	Nabawa ...	25	18	14	14	8	79
Smith, H. D.	Royal ...	Nabawa ..	24	17	14	14	8	77
ZONE 7—								
Stephens, F.	Lake Grace ...	Caliph ...	31	19	14	14	9	87
Freebairn, F. S.	Kulin ...	Queen Fan ...	26	19	14	14	8	81
Bishop, H. ...	Lake Grace ...	Nabawa ...	25	19	14	14	8	80
Trotter, A. W.	Kulin ...	Hard Federation	26	18	14	14	8	80
ZONE 8—								
Parkinson, A. W.	Gnowangerup	Yandilla King	40	18	14	13	9	94
Davis, N. ...	Gnowangerup	Nabawa ...	39	18	14	14	8	93
Stone, J. D....	Royal ...	Nabawa ...	31	18	14	14	8	85
Wilson, A. F.	Royal ...	Yandilla King	32	18	14	13	8	85
Estate M. Clifford	Royal ...	Nabawa ...	24	18	14	14	9	79

ZONE CHAMPIONSHIP AWARDS—*continued.*

ROYAL AGRICULTURAL SOCIETY—ZONE CHAMPIONSHIP AWARDS.

50 ACRE CROP COMPETITION, 1928.

Zone.	Competitor.	Address.	Society.	Variety.	Total points.	Place.
1	Forrester, J. K. ...	Carnamah ...	Royal	Nabawa ...	87	1st
	Hebiton, J. K. ...	Three Springs	Royal	Merredin ...	81	2nd
2	Honner, R. J. & Sons	Dalwallinu ...	Dalwallinu ...	Gluyas Early...	77	1st
	Porter, F. A. ...	North Ajana ...	Royal	Nabawa ...	72	2nd
3	Bryan, P. A. ...	Wongan Hills	Wongan Hills	Nabawa ...	82	1st
	Sawyer, T. G. ...	Goomalling ...	Goomalling ..	Nabawa ...	81	2nd
4	Young, G. J. ...	Talgomine ...	Nungarin ...	Gluyas Early	80	1st
	Creagh Bros. ...	Kwelkan ...	Nungarin ...	Nabawa ...	77	2nd
	Dunkley, G. A. ...	Yelbeni ..	Mt. Marshall...	Gluyas Early	77	2nd
5	Deane-Hammond, J.	Kellerberrin ...	Royal	Carrabin ...	81	1st
	Strange, P. A. ...	Yarding ...	Bruce Rock ...	Gluclub ...	79	2nd
6	Richards, T. ...	South Caroling	Royal	Nabawa ...	79	1st
	Smith, H. D. ...	Beverley ...	Royal	Nabawa ...	77	2nd
7	Stephens, F. ..	Lake Grace ...	Lake Grace ...	Caliph ...	87	1st
	Freebairn, F. S. ..	Kulin	Kulin	Queen Fan ...	81	2nd
8	Parkinson, A. W....	Gnowangerup...	Gnowangerup...	Yandilla King	94	1st
	Davis, N.	Gnowangerup...	Gnowangerup...	Nabawa ...	93	2nd

LEADING COMPETITORS FOR ROYAL SOCIETY'S SPECIAL PRIZE FOR HIGHEST YIELD IN ANY ZONE.

Zone.	Competitor.	Address.	Variety.	Calculated Yield.
8	Parkinson, A. W. ...	Gnowangerup ...	Yandilla King ..	40
8	Davis, N.	Gnowangerup ..	Nabawa	39
8	Johnston, Alf.	Gnowangerup ...	Bena	36
8	McDonald, John ...	Gnowangerup ...	Nabawa	36
1	Forrester, J. K. ...	Carnamah	Nabawa	35
8	Wilson, A. F.	Dumbleyung ...	Yandilla King ...	32
8	Milne, M	Borden	Nabawa	32
7	Stephens	Lake Grace ...	Caliph	31
8	Ball, J. I	Gnowangerup ...	Bena	31
8	Stone, J. D.	Borden ...	Nabawa	31
1	Hebiton, J. K ..	Three Springs ...	Merredin	30
3	Sawyer, T. G	Goomalling ..	Nabawa	30
3	Bryan, P. A.	Wongan Hills ...	Nabawa	29
1	Hunt, E.	Three Springs ...	Carrabin	28
1	Cuming Bros.	Inering ...	Nabawa	28
8	Whyatt, C. A.	Pallinup	Dron	28
3	Slater, W. G.	Wongan Hills ..	Nabawa	27
3	Hughes, J. R.	Minnivale	Nabawa	26
3	Ackland, R. B.	Wongan Hills ...	Merredin	26
5	Deane-Hammond, J.	Kellerberrin ..	Carrabin	26
7	Freebairn, F. S.	Kulin	Queen Fan ...	26
7	Trotter, A. W.	Kulin	Hard Federation	26
8	Murray, G.	Borden	Nabawa	26
8	Wright, E. A.	Pallinup	Bena	26
2	R. J. Honner & Sons... ..	Dalwallinu ...	Gluyas Early ...	25
5	Strange, P. A.	Yarding	Gluclub	25
5	Smith, C. & Sons	Yarding	Gluclub	25
5	Barton & Sons ...	North Baandee ...	Gluyas Late ...	25
6	Richards, T	South Caroling ...	Nabawa	25
7	Bishop, H	Lake Grace ...	Nabawa	25
7	Woodburn.	Lake Grace ...	Yandilla King ...	25
7	Lay, ...	Lake Grace ...	Nabawa	25
7	Bowey, J. P.	Kulin	Ford	25

OBJECTS OF THE COMPETITION.

The object of the competition is to raise the standard of wheat growing throughout the State, whereby the average wheat yields per acre will be increased. Gratification of this desire can only be accomplished in a society of enlightened and intelligent farmers—prepared to learn themselves and at the same time by their example, teach their neighbours. A district devoid of community spirit is lacking in enterprise. The community spirit is fostered by a competition such as this. Not only does the competitor—and his neighbour who does not compete—visualise other farmers in the district in a different light, but he becomes part and parcel of a competition extending over the whole of the wheat belt. His outlook is bounded not by the narrow limits of what is done in his own particular district, but by a knowledge of the fact that there are practical men either farming better than he or who may be doing so in the future. The results obtained by farming along definite, up-to-date methods advertise important and valuable knowledge from the more experienced to the less experienced settlers. The competition is concerned, not with finding the best farmer in the State, but with demonstrating in a practical way, that where recommended methods are employed, reasonable success follows.

Consequently, there is forged a closer link between the farmer and the Department of Agriculture.

The Season.

The season under review was one which caused anxiety and at times, alarm, regarding the prospects of the crops.

The summer and autumn months were unusually dry and consequently the fallow land received but little attention, as the rain which fell was insufficient to destroy the mulch or cause the weed seeds to germinate. May was also unusually dry and the month was well advanced before the seasonal rains began. Under such circumstances little or no opportunity was offered to prevent weed growth.

It was not until July that good soaking rains were experienced. During this and the following month normal conditions prevailed and at the end of that time the prospects were promising. Unfortunately, however, these conditions did not continue; no rain of any consequence was experienced in the Eastern districts after the first week in September. This period is the most critical in the growth of the wheat crop and, therefore, the anxiety which was felt was not unwarranted.

This being so, the lack of rain during the months of September and October provided a severe test of the efficiency of the methods practised.

The yields which were obtained show that the methods are sound and can be followed with confidence.

There is little doubt that in practically all districts the yields were reduced by the adverse weather conditions which prevailed. Fortunately, they were not reduced to the extent it was anticipated before the judging of the crops was commenced. A reason for this is immediately looked for and when analysed four factors present themselves as being most responsible, viz., Fallowing; the planting of suitable varieties; planting at the correct time, and the liberal application of superphosphate.

Entries.

The total number of competing crops inspected was 114 compared with 100 the previous year. This increase in a year of scanty rainfall indicates that the competition is not lacking in interest.

Entries were received from thirteen district Agricultural Societies, whilst twelve entries were received direct by the Royal Agricultural Society.

Fallowing.

All the competitors ploughed their land for their competition plot during the months of June, July, or August of the previous year. In this connection it has been demonstrated by experiments that a higher yield may be expected from the land when ploughed early in the fallowing season than when ploughed later. From an experiment conducted at the Merredin Experiment Farm, the average results show that an increase of four bushels four lbs. per acre was obtained from the plots fallowed in June as compared with the plots ploughed in August.

The average depth of the initial ploughing was from three to four inches, both disc and mouldboard ploughs being used for this operation. The advantage of using either type of implement is determined by the type and condition of soil to be ploughed. Whether the disc or the mouldboard plough be selected, it is essential that the work be done thoroughly.

It is particularly pleasing to note that many of the competitors are appreciative of the value of sheep to assist in controlling weed growth on the fallowed land.

Some of the reasons for fallowing are the conservation of moisture, the destruction of weed growth, the enrichment of the soil's supply of plant food, the control of disease, and the preparation of a suitable seed bed. Since the majority of the competitors are farming with these objects in view, it is not surprising to find a striking similarity between the methods adopted for the preparation of the seed bed. The springtyne cultivator was the implement chiefly used for the cultivation subsequent to the initial ploughing. A disc implement, however, was favoured for cultivations where the land was hard or weedy.

Varieties.

As was the case in 1927, the most popular variety was "Nabawa," 53 of the 114 competition crops being planted with this standard midseason maturing variety. The consistent yields obtained from this variety over a number of years, and its resistance to drought and disease have been sufficient to justify the confidence which the wheat farmers of the State have in this, a variety which has proved suitable for all districts.

Fifteen competitors submitted crops of the early variety, "Merredin." The growing popularity of "Merredin" is justified where an early variety is desired for planting late in districts of an assured rainfall. The standard early variety "Gluyas Early" was planted by thirteen competitors.

The variety "Gluclub" was planted by five competitors, all of whom were located in the Bruce Rock area.

Four competitors planted the standard late variety, "Yandilla King." It was a crop of this variety—so suitable for late districts—which, again, secured the Royal Agricultural Society's Prize for the highest yield in this Competition.

Three crops were planted with the variety "Ford" and the same number with the variety "Bena," while two of each were planted with "Canberra," "Hard Federation," "Queen Fan," "Caliph," "Gluyas Late" and "Carrabin."

The varieties "Toby's Tusk," "Gresley," "Wilfred," "Drof," "Walker's" and "Baroota Wonder Early" were each planted by one competitor.

Diseases.

Although reliable preventative methods are available for the prevention of Ball Smut, there are still some farmers who are not successful in entirely preventing this disease. The most popular method of treating the weed is the dry method with copper carbonate. When correctly applied, this method is effective in preventing the disease. It has the additional advantage that the seed can be treated immediately after harvest and when treated the copper carbonate acts as a preventative against vermin.

Although the majority of the competitors adopted the dry method, all of those who used it were not successful. The highly satisfactory results which many have obtained with this treatment indicate that failure with it is due to some defect in the methods of application. Effective results can only be obtained when the seed is dusted thoroughly with the powder. Those working the machines for treating the seed are sometimes inclined to treat the work as a "rush" job, and in consequence the grain is not covered as thoroughly as it should be.

The disease, "Flag Smut", was noticed in several of the crops. It is more difficult to control than "Ball Smut" or "Bunt," because the disease is transmitted through soil infection and distributed as a result of the spores on the foliage of the wheat plant being blown about. To control this disease it is advisable to plant a resistant variety such as "Nabawa." As an additional precaution, and particularly when resistant varieties are not available or are unsuitable for the special climatic conditions, the land for the next crop should be fallowed in the early winter months—June and July—and all weed growth which may appear on the fallowed land destroyed either by sheep or by cultivation. It is also advisable, where possible, to grow a crop of oats between the two crops of wheat.

Some crops were also attacked by the disease "Take-all." Unfortunately, no variety as yet is known to be resistant to this disease, and its control, therefore, depends entirely on the farming practice adopted. Suitable methods for the control of "Take-all" are similar to those already recommended for the control of Flag Smut. In addition, planting as late as is safe in the sowing period is beneficial. Early fallowing and late sowing should, therefore, be the methods adopted to control this disease.

The occurrence of Flying or Loose Smut of wheat is more difficult to prevent. Fortunately, it is unusual for crops to be seriously affected by this disease. The treatment of the seed for the control of Flying Smut of wheat cannot be economically undertaken. A reasonable control, however, is to be expected by planting clean seed from clean crops.

The disease Septoria is liable to occur in crops of early varieties of wheat planted too early. Under these conditions there is a tendency for the plants to make rank and flaggy growth, and as result they become more susceptible to infection by the fungus. The control of Septoria consists of seasonable planting and the practice of the clean farming methods recommended for the control of Flag Smut and Take-all. The inclusion of an oat crop in the rotation is also beneficial.

Time of Seeding.

The period during which the various crops were planted extended from the middle of April to the first week in June.

The following table shows the time at which the crops in the various Zones were sown:—

Zone.	Number of Competitors.	Number of Competitors Planting during:					Unknown.
		End of April.	First fortnight in May.	Middle of May.	Last fortnight in May.	Beginning of June.	
1	5	...	1	1	2	1	...
2	7	1	1	1	1	...	...
3	31	6	5	8	9	3	...
4	10	1	1	2	6	...	...
5	25	10	5	3	5	2	...
6	2	...	...	...	2	...	...
7	21	4	4	9	3	...	1
8	13	...	1	6	2	4	...
Total	114	22	21	30	30	10	1

Eighty-one of the competitors planted during the months of May, 21 in April, and 10 in June. Where it is necessary, owing to the area to be sown, to seed outside the month of May, it is better to plant suitable varieties in April rather than extend the period of planting into June.

Rates of Seeding.

The quantities of seed sown varied from 38lbs. to 75lbs. per acre. The table hereunder shows the rates employed in the different zones:—

Zone.	Number of Competitors.	Number of Competitors using:				Unknown.
		Under 45lbs. per acre.	45lbs. per acre.	45lbs. to 60lbs. per acre.	Over 60lbs. per acre.	
1	5	...	...	5	...	..
2	7	...	...	7	...	..
3	31	2	6	19	4	...
4	10	3	5	2	...	...
5	25	1	10	14	...	...
6	2	...	2	...	...	.
7	21	2	5	13	...	1
8	13	...	4	8	1	..
Totals	114	8	32	68	5	1

The majority of the competitors planted from 45lbs. to 60 lbs. per acre. Experiments conducted at the experiment farms show that whilst the yield is not decreased by the heavier rate of seeding, no advantage is gained by increasing the amount over 45lbs. per acre. At the Yilgarn farm the results (which are for one year only) showed that the yields were not decreased when the low rate of 23lbs. of seed was sown.

Fertilisers.

Superphosphate was applied by all competitors, the rates of application varying. In one case as high as 200lbs. per acre was applied. The average amount used by competitors was 90lbs. per acre—an increase of 4lbs. per acre over the average for the previous year.

There is a general tendency to increase the rate of application of superphosphate for the wheat crop. This is noted in the table below which indicates the quantities and average amount used in each zone, the averages being compared with those of the previous year.

Zone.	Number of Competitors.	Number of Competitors using:— Under 80 lbs. per acre.	80 to 99 lbs. per acre.	100 to 119 lbs. per acre.	Over 120 lbs. per acre.	Unknown.	Average rates in lbs. per acre, 1928.	Average rates in lbs. per acre, 1927.
1	5	...	1	4	...	...	108	123
2	7	1	5	1	...	...	86	69
3	31	2	9	12	8	...	102	90
4	10	1	6	3	...	...	91	81
5	25	1	18	4	2	...	91	86
6	2	1	...	...	1	...	100	101
7	21	5	9	3	3	1	92	85
8	13	1	9	1	2	...	102	87
Totals	114	12	57	28	16	1	90	86

The advantages of applying higher rates of superphosphate to the wheat crop is now becoming realised. This practice is encouraged because experiments carried out at the different experiment farms with different rates of applications, the results of which appear elsewhere in this publication, show that the yields of the wheat crop are increased when the heavier rates of superphosphate are applied.

Yields.

In the final remarks in the report on last year's crop competition, it was mentioned that the test of efficient farming comes when the season is least favourable.

The table below shows the comparison between the yields for the 1927-28 and the 1928-29 seasons. It is worthy of note that the rainfall registrations last season were, over the greater portion of our wheat belt, amongst the lowest on record.

Zones.	Number of Competitors.	Average calculated Yields.	Average calculated Yields, 1927.
1	5	29·0	28·0
2	7	19·3	22·4
3	31	21·3	25·6
4	10	18·3	29·2
5	25	20·4	26·2
6	2	24·5	29·0
7	21	23·0	25·6
8	13	31·1	32·0
Totals	114	22·5	26·9

The average calculated yield for all competing crops inspected this year was 22.5 bushels per acre, that for 1927 26.9 bushels, and for 1926 24.5 bushels per acre.

In view of the adverse growing season, these results are most gratifying and encouraging and are sufficient evidence to indicate that the methods which are advocated, and which are practised by the leading wheat farmers, can be continued and followed with confidence, and when generally adopted the average yield of the State will be increased.

SOIL ALKALI

(Continued.)

L. J. H. TEAKLE,
Plant Nutrition Officer.

III.—THE PROBLEM IN WESTERN AUSTRALIA.

In the earlier sections of this series an attempt was made to present the principles involved in the question of soil alkali or salt as a preliminary to the discussions of the problem as it confronts the farmer and orchardist in Western Australia. No attempt has been made in the past to define the problem in the Western Australian publications, but there is considerable literature as a result of investigations in various areas. In this paper full use is being made of the excellent discussion of the problem by Professor Paterson in his report to the Royal Commission on the Mallee Belt and Esperance Lands, Appendix 15, p. 165, 1917. The report deals with the nature and occurrence of alkali in soils of the district to the North of Fsperance and affords data which will be supplemented by information collected by the writer.

Personal interviews with various people of experience in Western Australia have also contributed to this discussion in no small measure.

THE SOURCE OF ALKALI IN W.A.

The alkali is the result of—

1. Rock and soil weathering with the liberation of soluble materials,
2. Impregnation of the soil with soluble salts carried down in the rain,
3. Residues from the evaporation of inland seas.

In Western Australia these factors are all of importance in various areas. The factor of most general importance is that connected with rainfall.

Professor Paterson reports (*loc. cit.* p. 186) the analysis of rain water from a tank at Gibson's Soak Hotel, near Norseman. This water contained 95 parts of common salt per million (6.7 grains per gallon). Similar records have been obtained in South Australia and are reported by Mr. J. Lockhart Jack in Bull. 8 pp. 27-29, Geological Survey of South Australia, 1921. Rain water samples (from tanks) contained over 100 parts per million of dissolved salts (7.9 grains per gallon). Mr. Jack has calculated that from 100 to 300 pounds of salt per acre per annum is carried down with the rain in Yorke's Peninsula, South Australia.

Mr. W. E. Wood, Inspecting Engineer of the Railway Department discussed the problem in a paper to the Royal Society of Western Australia (Jour. Roy. Soc. Western Australia X pp. 35-47, 1923-4) and reported figures for the South-West portion of this State. Analysis showed that not infrequently rain falling on the Western slopes of the Darling Range carries with it 40 parts of salt per million (3 grains per gallon).

The salt content of the rain water is much higher following gales from the sea and during the early part of the precipitation. Mr. Blatchford, the Government Geologist, recently toured the Esperance district and in the course of his travels inspected a small waterhole at the top of a granite outcrop. The water was as salt as brine. This salt must have been deposited by the rain and accumulated as a result of evaporation of the water caught annually throughout many decades.

The rain collects the salt from the air as a very fine dust. This dust is derived from the evaporation of sea spray and from the surfaces of salt deposits. There is no data to prove the relative importance of each source, but it is safe to say that the importance will depend on the proximity of the sea or salt lake and the direction of the prevailing winds. When it is realised that this process continues for geological ages it is not difficult to comprehend the possibilities as a result of the movement of *cyclic salt*. The term "cyclic salt" is used by geologist to describe the soluble salts which are blown into the atmosphere in sea spray as a result of heavy gales. This salt remains suspended in the air as a very fine dust until it is washed to earth by rains. Following its deposit on the soil the "cyclic salt" makes its way to the sea by means of surface run-off and seepage into rivers and streams draining to the ocean or inland basins whence it came. In certain areas, this salt is trapped in the local drainage basins which, in many cases, are the remains of the river system of bygone ages. The climate has so changed that the river channels are now represented by the salt "lakes" so familiar in many parts of Western Australia. Depending on the contour of the country these lakes resemble narrow channels or expanded sheets. No doubt local cycles occur in these areas—the salt being blown into the air from the surface of the lakes, to be redeposited on the soil when the movement back to the lakes begins.

Geological evidence shows that the southern part of Western Australia was submerged in the Tertiary period—that is in comparatively recent times according to the geologists' calendar. With the elevation of the area inland lakes would be formed and, on evaporation of the water, the soluble material would remain. Perhaps some of the salt lakes of the Esperance-Norseman area originated in this manner.

DISTRIBUTION OF ALKALI IN THE SOIL.

Following the deposition of the alkali salts on the soil by whatever means, distribution is effected by means of moisture movements in the soil. With the percolation of water through the surface layers the soluble materials are carried downwards. Three types of distribution may be recognised.

1. Where the rainfall is sufficient to provide adequate drainage the soluble salts appear in the creeks and are carried to the sea or to inland drainage basins. Examples of this may be met with in the South-West of this State where the creeks entering the sea are often extremely salt. This salt was leached from the soil by percolating waters and will return to the sea whence it came, thus completing the cycle.

2. In the semi-arid or arid districts the alkali will be leached to a certain depth only and will accumulate in the subsoil. The Eastern wheat belt falls in the semi-arid zone, the rainfall being from 10 to 14 inches only. In the virgin state the rains saturate the soil in the surface layers only. In dry seasons as in 1928, the soil is never saturated below one foot to eighteen

inches deep. In wet years the depth of saturation will be considerably deeper. A measure of the average depth of saturation is given by the occurrence of an accumulation of alkali. Under normal conditions in the forest there is little or no movement to the surface by capillarity because the roots absorb the moisture too rapidly. Where root action is insufficient the intense drying action of grasses and winds in spring dessicates the surface, forming a natural mulch. Through this mulch the moisture escapes as a vapour, just at petrol escapes from a tin with a hole in the top. Now alkali does not move with vapour, but remains in the subsoil. Examples of analytical data to support these contentions are given below.

Professor Paterson (*loc. cit.* p. 174) gives in table 10 the results of analysis of 10 samples of soil from the Esperance area. The average concentration of sodium chloride (common salt) at the three depths sampled are as follows:—

Depth	0 to 6 in.	6 to 18 in.	18 to 36 in.
Sodium Chloride, per cent.	0.073	0.185	0.339

In the course of the investigations in the Lake Brown area by District Inspector Cook and the writer, similar results as hereunder were obtained from the examination of over 100 samples:—

Depth	0 to 12 in.	12 to 24 in.
Total Salts, per cent.	0.123	0.213

With the clearing of the timber the balance between the vegetation, the soil and the rainfall is upset. Supposing a heavy forest to absorb four inches of water over an acre per year in transpiration, it is obvious that this amount of water must find some other avenue of escape following the clearing of the land.

Some will evaporate; some will reach the lower levels by surface run-off; a considerable portion will percolate in the soil carrying with it the soluble salts present in the lower layers of soil. Springs or damp patches will form in the lower contours where this water comes to the surface. With the surface evaporation from the damp patches alkali will accumulate. This process has been going on for long periods in certain areas resulting in salt lakes, which in many cases are only old river channels—vestiges of a wetter climate. With the progress of clearing, other areas of low elevation will become part of the drainage system and the local areas will become affected by salt. Soils bearing Morrell (*E. longicornis*) and Yorrell (*E. gracilis*), particularly in the vicinity of salt lakes, are salt liable and it will often be noticed that there is a more or less permanent dampness associated with the salt patches. As these soils usually occupy the lower levels, and may even be silted up lake or pond basins, it is not at all surprising that this condition exists. Given an outlet to lower levels, for instance to a lake, it is quite possible for the silty soils bearing morrell to be quite free of excess alkali. In fact much of the country carrying morrell is quite valuable agriculturally and may be farmed successfully when due recognition of the physical nature of the soil is made.

3. The third type is intermediate between the first and second types and is represented by the Great Southern districts, the Geraldton district and others. The rainfall is generous and there is an abundance of creeks which flow in the rainy season. Following clearing of the timber the flow of the creeks increases, new creeks arise, springs or seepage zones appear and, with the evaporation of these springs or seepage zones, salt patches form. The analyses of water from two springs from Mr. J. Edward's farm at East

Pingelly will illustrate the principle. These springs occur on a c'eared slope and are about two chains apart. The lower one is now quite salt, while the upper one is quite fresh. The area between the two springs has become affected with alkali due, no doubt, to the evaporation of water leaving behind the soluble salts. In the course of years the accumulation results in the land becoming sterile unless drainage and the removal of these salts is effected.

The analyses are as follows:—

	Total Salts. Parts per million	Sodium Chloride. P.P.M.	Grain/gallon
Fresh Spring (top of salt area)	294 ..	148 ..	10.5
Salt Spring (lower part of salt area)	8,056 ..	7,452 ..	530

Examples of a similar nature may be seen in the Darling Ranges, along the Northam to Perth road and almost anywhere that the timber has been cleared in this zone.

The writer is particularly familiar with parts of the Northampton district where, as a result of clearing and ring-barking, springs appeared and areas became affected with alkali. During the early stages of the devel-

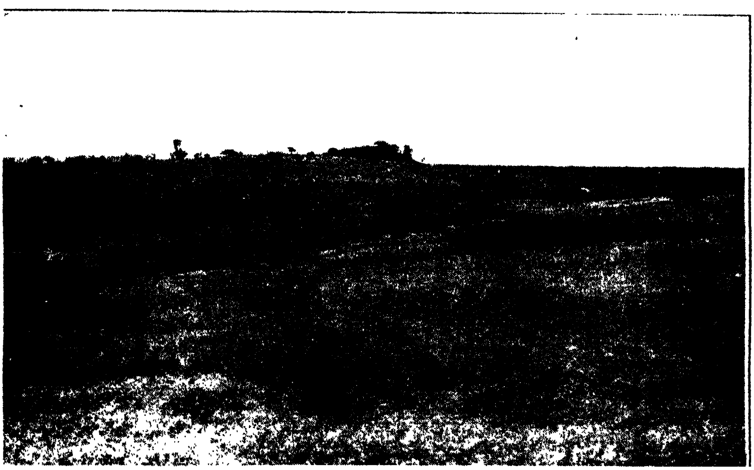


Plate 2.

Alkali patches appearing in depressions following the clearing of timber at Isseka.

(Photo by L. J. H. Teakle.)

opment of this district the alkali increased at an alarming rate, but the tide turned and now the affected areas have stopped increasing or have decidedly improved. Plate 2 illustrates the occurrence of alkali in a recently cleared

field at Isseka, Northampton. It is to be noticed that it is the lower levels, that is, the small valley, that has become affected. It may be predicted that with the continual leaching of the winter rains this area will improve as the soluble materials are washed down the creeks.

TYPES OF COUNTRY AFFECTED WITH ALKALI.

In his report to the Royal Commission (*loc. cit.* p. VI.) Mr. Surveyor Middleton estimated that of the 1,540,000 acres surveyed in the mallee belt and Esperance lands, larger salt lakes comprised 35,000 acres while the smaller salt lakes accounted for about 48,500 acres, a total of 5.5 per cent. of the total area. It is highly probable that a similar area is occupied by depressions which will become saline following clearing. Plate 3 illustrates

Plate 3.

At 120-mile post near Norseman, showing saltbush, etc. This represents an incipient salt lake. (Photo. from Report by Professor Paterson to the Royal Commission on the Mallee Belt and Esperance Lands, 1917, p. 189.)

an area carrying salt bush near Norseman. As far as cropping is concerned, this area may be regarded as an incipient salt lake, as the soil is already quite saline, the analyses being as follows:—

Depth.	Sodium chloride per cent.	Total salts, per cent.
0 to 12 in.	0.413	0.625
12 to 24 in.	0.318	0.592
24 to 36 in.	0.438	0.624

(Professor Paterson's report *loc. cit.* pp. 178-9 and Plate 6.).

Plate 4 illustrates similar country in the vicinity of Lake Brown. The prevailing timber is morrell with abundant salt bush. Examination showed this section to be inclined to alkali. Another area in the Lake Brown district carrying saltbush on ringbarked and cleared morrell country was examined more carefully later with the following results:—

	Total salts, per cent.
First foot (11 samples)	0.24
Second foot (10 samples)	0.52
Third foot (2 samples)	0.45

Plate 4.

Typical country liable to alkali in the Lake Brown area. The timber is a Morrell with saltbush undergrowth.

(Photo by L. J. H. Teakle.)

Although the surface foot of soil contains only 0.24 per cent. of total salts, which is at the upper limit for cropping, the subsoil is highly impregnated with alkali and the area represented by these samples must be considered unsafe for cultivation. While country carrying salt bush must be regarded as suspicious with respect to salt, the presence of salt bush is not an infallible guide as many determinations showed that samples from these areas were not affected with alkali. On the average, however, it would probably pay to fence the salt bush country and preserve it for pasturage. It is suggested that the information in the appendix prepared by Mr. C. A. Gardner be used as a guide to areas likely to be affected with alkali and that such country be not cleared for cultivation without a thorough inspection.

In the more Western sections of Western Australia, where the rainfall is higher, patches in any class of country may become affected with alkali

if subjected to an excess of water which is allowed to evaporate. Small patches of saline soil may be found in the valleys of the Darling Ranges; in the granitic country bearing Jam (*Acacia acuminata*), York Gum, (*Eucalyptus foecunda*) and associated timbers; and in other sections where the movement of moisture is conductive to surface evaporation throughout a considerable period of the year.

THE CHEMICAL NATURE OF THE ALKALI.

In the previous article tables were presented showing the composition of soil alkali in various parts of the world. According to the conditions, carbonates, sulphates, chloride or even nitrates may predominate. Magnesium salts cause trouble in rather rare cases.

In Western Australia Sodium chloride or common salt is the prevailing alkali salt. This fact is illustrated by the analyses reported in Tables 7 and 8.

TABLE 7.

Analysis of water soluble salts extracted from three composite soil samples from Lake Brown area (Analyses by Government Analyst using 1–2 water extract).

Constituents (Ions).	Parts per million of soil.		
	Soils 2 and 3.	Soils 4 and 8.	Soil 10.
Carbonate (CO_3)	84	108	126
Sulphate (SO_4)	426	158	112
Nitrate (NO_3)	602	205	43
Chloride (Cl)	1,698	889	387
Calcium (Ca)	161	113	30
Magnesium (Mg)	96	34	14
Potassium (K)	44	57	Trace
Sodium (Na)	1,199	583	356
Equivalent Sodium Chloride	2,800	1,470	638
Total Salts	4,310	2,147	1,068
Sodium Chloride per cent. of total Salts	65%	68·5%	59·8%

TABLE 8

Analyses of water soluble salts extracted from soils from the Esperance lands and elsewhere as reported by Professor Paterson in his report to the Royal Commission (loc. cit., p 181). Analyses of sample from second foot only.

(Calculated from analyses made in 1917 by Mr. E. S. Simpson, Government Mineralogist and Chemist.)

Constituents (Ions).	Parts per million of Soil.							
	Soil 3B	Soil 5B	Soil 7B	Soil 8B	Soil 10B	Soil 12B	Soil 13B	Soil 14B
Carbonate (CO_3) ...	398	66	247	238	225	260	*Nil*	223
Sulphate (SO_4)	340	228	*Nil*	484	572	367	223	215
Nitrate (NO_3)	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*
Chloride (Cl)	647	67	80	2,905	2,909	2,028	2,222	1,126
Calcium (Ca)	30·7	30·7	22·1	37·9	*Nil*	30·7	6·4	12·9
Magnesium (Mg) ...	40·8	18·6	33·6	58·2	61·2	68·4	28·8	24·0
Potassium (K)	77	23·2	16·6	50	56·5	47·3	40·7	23·2
Sodium (Na)	735	118	142	2,115	2,185	1,505	1,460	930
Total Salts	2,267	552	541	5,884	6,008	4,298	3,983	2,556
Equivalent Sodium Chloride	1,071	111	132	4,789	4,796	3,343	3,663	1,857
Sodium Chloride per cent of total Salts	47·3%	20·5%	24·4%	81·5%	79·8%	77·9%	92·0%	72·8%

Of the soils containing over 0.2 per cent. of total soluble salts (the only soils which should be regarded as alkali soils) in only one (3 B) does sodium chloride or common salt constitute less than fifty per cent. of the total soluble matter The average of the eight alkali soils reported in Tables 7 and 8,

which represent samples from Kellerberrin (13 B), Lake Brown and various parts of the Esperance area, shows that sodium chloride constitutes 73.1 per cent. of the total soluble salts of these soils.

It is interesting to note that sodium chloride constitutes about 77.75 per cent. of the dissolved salts in sea water. This fact supports in some measure the theory of "cyclic salt," as contributing to the salinity of soils.

None of the soils examined exhibit any considerable portion of sulphate or carbonate. Again, there is no evidence of "magnesia" being in sufficient quantity to be deleterious. Even gypsum or calcium sulphate is not present in any great amount in the majority of soils examined. Of course banks of gypsum occur in association with the salt lakes, but these are of no great extent as far as agricultural soils are concerned.

It may be concluded that in the majority of alkali soils of Western Australia, sodium chloride is the chief soluble constituent and is the harmful element.

THE EXTENT OF ALKALI AFFECTED AREAS.

There is no accurate estimate of the area of agricultural land which is affected by alkali. Surveyor Middleton estimated that about 5.5 per cent. of the Esperance Lands was actual salt lake so that it may be safely assumed that 10 per cent. of that area may be not worth clearing. In most other sections of Western Australia, the area which agriculturally is useless on account of rough hills, stony outcrops, creeks and other impediments, far exceeds the area which has actually "gone salt" following clearing. Few farmers can say that any considerable percentage of their farms has become affected with alkali. In the Lake Brown district, certain local areas are definitely affected by alkali, but these areas either carry salt bush in association with Yorrell (*E. gracilis*) and Morrell (*E. longicornis*) or occupy low lying parts to which even surface water drains in wet season. It is doubtful if over five per cent. of the arable land in this area is likely to be salt-affected. In most other areas the amount of salt-affected land will be considerably less.

As a result of enquiries by a Committee of the Royal Society of Western Australia, figures concerning the area of lands affected with alkali were obtained from Wagin and other centres on or near the great Southern Railway; from the Eastern wheat belt, including Lake Brown, Nungarin, Koorda and Wubin; and from Rockwell near Yuna, in the Northern part of the Wheat Belt. Calculations from the estimates given by farmers concerned, led to the results expressed in Table 9.

TABLE 9.

Area of land affected by alkali following the clearing of the timber on certain farms in the wheat belt of Western Australia.

Locality.	Total Area.	Area affected with alkali.	Per cent.
	acres.	acres.	
Wagin (6 farms)	9,252	291	3·1
Other G.S.R. Centres (12 farms)	25,692	289	1·1
Total for G.S.R. Centres (18 farms)	34,944	580	1·7
Other Centres (11 farms)	25,753	1,320	5·1
Total for State (29 farms)	60,697	1,900	3·1

(The writer is indebted to Mr. W. E. Wood, who kindly supplied the figures upon which these calculations were made.)

The highest figure reported was from Nungarin, where 27.5 per cent. of a thousand acre farm was affected with alkali. It is interesting to note that this farm is intersected by a chain of salt lakes and probably should never have been offered for selection.

RECLAMATION OF ALKALI SOILS.

The principles involved in the reclamation of alkali soils have already been discussed in an earlier part of this article. Most types of reclamation practice are suitable only for very valuable land and even then authorities often advise an expensive reclamation programme to bring back to fertility small patches which have arisen as a result of faulty irrigation practice. In Western Australia where land is relatively cheap, it will not pay to spend £15 or £20 per acre on reclamation, and measures must be adopted to suit local conditions.

In the Darling Ranges certain examples have come under the notice of the writer where a "salt patch" has been forming in a small valley, say, at the junction of two creeks. For a very small expenditure it should be

Plate 5.
A useful type of ditching machine recommended by the Irrigation Officer.
(Reproduced from "Surface Drainage with the Martin Ditcher," Fig. 2, By A. R. C. Clifton, Leaflet 140, Department of Agriculture, West Australia, June, 1924.

possible to adequately drain these patches before the soil becomes badly affected. Open drains cut about 2 or 3 feet deep by means of a plough and small ditcher (Plate 5) should be effective in the early stages. It would be necessary to drag a heavy log or ditcher down these drains occasionally to keep them clean until it was practicable to put in tiles. Fertile patches, perhaps an acre or so in extent, might thus be saved for summer fodder such as sorghum, maize or Sudan Grass.

In the Northampton district the writer has seen irregular gutters develop in the fertile depressions making it necessary to abandon small strips in certain paddocks. While it would not pay to cut drains in these paddocks at

the present value of land, the appearance of the paddock would be improved by systematic draining of these small areas and cultivation would be simplified.

Reclamation of some patches affected with alkali along a water course through his property at "Daliak," York, has been effected by Mr. A. J. Monger. The result was achieved by the application of a heavy dressing of stable manure and, later, sheep manure, and then planting subterranean clover with an application of superphosphate at the rate of 1 cwt. per acre. (Geo. L. Sutton, "The Reclamation of Salt Land at 'Daliak'" Journal of the Department of Agriculture of Western Australia, Vol. 4 pp. 199 to 201, 1927.) Whether this treatment will effect permanent improvement the test of time will tell. Excellent growth of pasture was obtained in the years immediately following the treatment.

The Eastern Wheat belt presents another problem as the distribution of alkali salts in the soil is more general owing to climatic factors. These soluble materials are very slowly moving to the salt lakes and local drainage basins, and the problem seems to be a recognition of those areas which are now drainage basins or will later become affected as a result of the increased moisture movement following clearing. Mr. C. A. Gardner, in the appendix, has dealt with the vegetation which very generally signifies the presence of alkali and this guide is to be recommended. Areas suspected of being liable to alkali should be used for pasture purposes. Ring-barking would encourage the growth of more edible herbage.

While many farmers are growing successful crops right up to the edge of salt lakes, there is evidence of a sufficient number of cases of failure to suggest the need for extreme caution in the bringing into cultivation of lands bordering the lakes. If the slope of the land and the drainage conditions are favourable, a rise of alkali to any large extent need not be feared, even adjacent to salty depressions, but care must be taken to ascertain these facts before investing much capital in the clearing of these lands.

Plate 6 illustrates a typical salt lake.

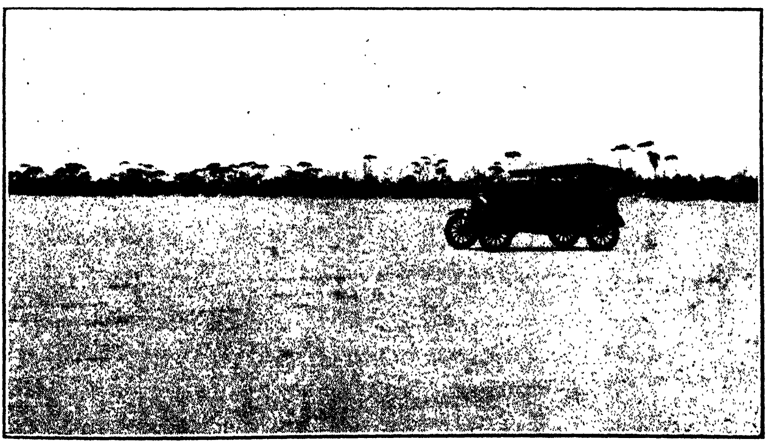


Plate 6.

A typical Salt Lake in the Lake Brown area.

(Photo. by L. H. J. Teakle.)

It has been said that clearing of land along creeks frequently leads to a rise of salt. As a matter of fact trees along creeks have often been killed owing to the rise of salt. This rise is due to the clearing of the large catchment areas on the *higher* slopes. In the absence of the timber on the rises more water percolates towards the creeks carrying with it soluble salts leached from the soil. In the lower levels the water table rises and salt is brought to the surface or feeds the creeks which become more saline.

CROPS FOR ALKALI SOILS.

Mr. Gardner is dealing with this problem in the appendix. Suffice to say that Atriplex species may be useful in the Eastern Wheat Belt to provide a permanent pasture as a standby. In the areas receiving more liberal rainfall, couch grass, sorghum, maize, sudan grass, etc., may prove useful summer crops as the areas liable to alkali are kept moist by underground seepage for at least a considerable portion of the summer.

Contrary to the popular belief, certain determinations made in the Lake Brown area indicate that Barley Grass (*Hordeum murinum*) is not very resistant to alkali. Patches in a wheat crop growing barley grass in profusion and no wheat contained from 0.023 to 0.20 per cent. alkali, averaging 0.058 per cent. alkali in the first foot. In one section near Lake Brown samples were taken from a patch of barley grass, an adjacent bare patch and from the wheat adjoining the bare patch. The results are expressed in Table 10.

TABLE 10.

The Tolerance of Barley Grass (*Hordeum murinum*) for alkali.

Soil sample.	Alkali per cent. in Soil.		
	Barley grass patch.	Bare patch.	Wheat crop.
	%	%	%
1st foot	0·20	1·10	0·23
2nd foot	...	0·86	0·42
3rd foot	...	0·70	...

The presence of Barley Grass with the failure of wheat does not necessarily imply the presence of alkali.

SUMMARY.

1. In a series of three papers the question of soil alkali is discussed.

   (a) As to its nature and occurrence,

   (b) As to the tolerance of plants for alkali in soil.

   (c) With regard to the problem in Western Australia.

2. Alkali is defined as those soluble materials which exist in the soil in excessive amounts. White alkali and black alkali are defined.

3. Alkali originates from various sources, the most important of which are—

(a) Soil decomposition in the process of weathering,

(b) Residues from the evaporation of bodies of water.

(c) "Cyclic" salt carried by the wind, especially from the ocean, and applied to the soil in rain water.

4. Plants differ in their tolerance for alkali. Tables are presented summarising work in America on this question.

5. In the State of Western Australia alkali manifests itself—

(a) In the salinity of streams in the wetter portions of the State,

(b) As patches, usually small, in valleys, creeks or below springs, in areas represented by Northam, Pingelly, and Northampton. The accumulation is often the result of increased moisture movement following the clearing of timber,

(c) As an accumulation, usually in mild amounts, in the subsoil of the Eastern wheat belt. This condition becomes acute in certain low lying areas, particularly in soils bearing salt bush with Morrell and Yorrell.

6. The commonest constituent of the alkali of West Australia is sodium chloride which amounts to about 75 per cent. of the total soluble salts. Danger from "magnesia" *may* occur, but in very rare cases.

7. It is estimated that less than 5 per cent. of the arable land of the State is affected with alkali.

8. By way of reclamation certain suggestions are made:—

(a) Provisions of a simple drainage system in the small patches in the wetter areas and the growth of summer crops on these areas.

(b) Use of land suspected of bearing alkali in the Eastern Wheat belt for pasturage purposes.

9. An appendix has been prepared by Mr. C. A. Gardner, the Government Botanist, dealing with the vegetation of soils liable to alkali and suitable plants to be grown on these areas if reclamation is contemplated.

The writer begs to acknowledge indebtedness to Mr. G. L. Sutton and Mr. C. A. Gardiner, who kindly read the paper and made useful suggestions, and particularly to Mr. C. A. Gardiner who prepared the Appendix.

APPENDIX.

By C. A. GARDNER.

Plants of saline soils are termed Halophytes or Salt plants. They frequently form definite associations wherever the soil is too saline to support the prevailing vegetation of the vicinity. Before halophytic vegetation can be brought into existence a certain amount of soluble salts must be present in the soil, and according to the degree of its concentration the characteristic vegetation differs. Plants growing in highly saline soils have one common feature which they share with plants of arid regions—they are xerophytes, or dry country plants. All possess special adaptations which reduce transpiration and consequent loss of water, for salt soils, even when moist, are dry as regards the plants moisture requirements, it being difficult to absorb water from a relatively concentrated salt solution. Hence to plants all salt soils are relatively dry, and irrespective of climate or elevation, there is a marked similarity between halophytic formations over the globe. In general, plants of salt soils are characterised by succulent stems or leaves, hairiness, scurfy leaves, thick and leathery leaves, or the plants may be leafless or spiny.

The drier portions of Western Australia are in many places characterised by salt pans, the so-called "Salt Lakes"—depressions which receive the surface water after heavy rains, and having no outlet the accumulated water evaporates, leaving deposits of salts. Some of these "lakes" are of considerable extent, many are linked together by channels which flow in exceptionally wet periods and are known as "salt rivers." Others again have an outlet to the sea, but the course is so long, and the periods when they flow throughout their length so very infrequent, that they usually function as lakes. These "lakes" even in the most arid country frequently have a treacherous mud in their beds, which is covered with the glistening ice-like deposits of salt which under the hot rays of the sun give most wonderful mirage pictures. To the south of the Mulga country, that is, generally south of the thirtieth parallel of latitude, the lakes are framed in Eucalyptus woodlands, but in the Mulga country to the north there is little beyond the encircling Swamp Oaks or Tea-trees to indicate their shores.

In the drier parts of the Wheat Belt it is usual to find trees of the Blackbutt and Morrel types fringing the salt pans in the loamy soil. The following are typical trees of their districts:—

Kondinin to Lake Grace and Newdegate: The Kondinin Stocking Tree or Lake Grace Blackbutt (*Eucalyptus Kondininensis*).

Salt River (Lake Brown, Hine's Hill, Wyola, Lake Meares, etc.): Salt River Gimlet (*Eucalyptus Sargenti*).

Eastwards from Merredin to the Goldfields: A Morrel (*E. oleosa*). Yorrell (*E. gracilis*).

The undergrowth is scanty, and consists very largely of Salt Bushes (*Atriplex mummularium, A. Drummondii, A. hymenotheca*), Rhagodia, and occasional plants of Blue Bush (Kochia) and Bassia. Occasionally thickets of Boree indicate the presence of salt. The herbaceous plants in these loamy soils are mostly Mesembryanthemum (a pig-face), Parakeelia (*Calandrinia spp*) and a few grasses, notably the spider grass (*Stipa elegantissima*) and Eragrostis.

Where the soil is of a lighter character the place of Eucalyptus is taken by the Swamp Oak (*Casuarina glauca*)—a species apparently restricted to saline soils throughout Australia. With it are grouped the Black Pine (*Callitris glauca*), and a few species of Tea-tree, notably the Tamarix-like Melaleuca thyoides. The actual "shore-line" of the salt pan in sandy soil is richer in succulents and small shrubs than the loamy soil. These are principally Samphires (*Arthrocnemum spp.*), small pink-flowered, small-leaved shrubs (Frankenia), Mesembryanthemum, "Pigface" and minor plants. The Samphires occupy the innermost fringe in the salt mud, they are banked in turn by Frankenia and the Tea-trees, and lastly by the Swamp Oaks. This picture might apply to the sandy shores of any salt pan in the dry areas. It is noteworthy that the sandy saline soil possesses a greater number of character plants than does the loamy soil where one frequently has nothing but the Eucalypts and Salt Bushes to denote the presence of salts.

In the South-West proper, true salt lakes are found. They are depressions in which the water is usually permanent and varies from brackish to excessively saline. The country in which these lakes occur is usually of a sandy nature. Tea trees take a prominent place in the bank vegetation, and to a less extent Swamp Oak and Flooded Gum. The Flooded Gum (*Eucalyptus rudis*) is however indicative of moist soils rather than salinity, and in this respect resembles the Flat-Topped Yate (*E. occidentalis*) which is found in clay depressions subject to inundation whether the water be fresh or salt. York Gum (*E. foecunda*, var. *loxophleba*) is also only occasionally of use as an indicator plant. It tolerates a certain soil salinity, but flourishes most in well drained granitic soils. Taken in conjunction with salt indicating shrubs it can, however, be useful as a guide, especially in the Morawa and Mullewa country. Unlike the conditions which prevail in the drier areas, the loamy or clay depressions in the South-West carry fresh water.

It is impossible in this appendix to enumerate, much less attempt to describe the plants which serve as indicators of salt soils, but the following descriptions may be found of some service.

The Kondinin-Lake-Grace Blackbutt (*Eucalyptus Kondininensis*). This tree is a typical Blackbutt, 40 to 60 feet in height. The trunk attains a height of 30 feet. The bark for a height of 3 to 7 feet above the ground is black, thick and flaky, and persistent. This rough bark ends abruptly (hence the fanciful allusion to a stocking), above the bark is smooth, shining and yellowish in colour, but blotched with patches of violet-grey bark. The timber is light to dark brown, dense, heavy and strong. The leaves are formed on a shallow crown like that of the Salmon Gum, and are dark green. This tree inhabits heavy loamy soil near Kondinin in the vicinity of Salt Lakes, and in forest soil where the undergrowth suggests salt. At Lake Grace and Newdegate it is a feature of the banks of the lakes.

A Red Morrel (*Eucalyptus oleosa*). This is one of the Red Morrels, and is a common tree of loamy soil inclining to salt from the vicinity of Lake Brown eastwards to Lake Lefroy. To all appearances it is a true Morrel scarcely to be distinguished from the common Red Morrel (*E. longicornis*) except by the short and blunt bud-cap (operculum) which in *E. longicornis* is long and tapering.

Salt River Gimlet or Bastard York Gum (*Eucalyptus Sargenti*). This tree extends from Lake Brown country westwards to near Quairading. It occurs on the scrubby tea-tree "islands" of the Salt River which emerges from

Lake Brown, and is abundant at Hine's Hill. It is also a feature of the Mortlock River flats at Wyola. The tree is fairly common in the salt soils of the Central Avon district, and is always associated with the Salt tea trees.

Yorrell (*Eucalyptus gracilis*). This tree is not absolutely indicative of salt soils, although it is a common tree of salt loamy flats. Here, owing to the exclusion of its common associate, the Salmon Gum, it develops into a much better tree than when associated with the latter, having a short stout trunk and widely spreading branches. It is found in this condition in the Eastern Wheat Belt and the Eastern Goldfields. Closely resembling the Morrels it is frequently mistaken for them, but can be distinguished from them by its habit of growth, and small dark shining leaves in a wide umbrageous crown, also by its narrow spindle-like fruits which are not unlike those of the York Gum, a tree which it somewhat resembles, but having very different leaves.

Swamp Oak (*Casuarina glauca*). This is a Sheoak which inhabits saline soils. It has drooping branches, and a foliage which is as much grey as green.

Boree (*Melaleuca spp.*). These trees, which are tea-trees with a straight trunk and rough dark grey bark, usually occur in thickets. Although not a feature of many salt pans, they occupy depressions which tend to become markedly saline. Their distribution is principally southwards from Lake Brown to Lake Grace and Newdegate, and they are very abundant near Karlgarin.

Salt Bushes (*Atriplex spp.*) These shrubs are conspicuous from a distance by reason of their grey-white foliage. The Old Man Saltbush (*Atriplex mummularium*) is the largest and one of the most common. The term Salt Bush, however, has been loosely applied to several shrubs of this type which are not necessarily plants of salt soils.

When the soil is known to be salt, cultivation should be avoided. In the wheat areas the establishment of crop plants on these soils is impossible. The native vegetation is the only one which can survive. It is therefore, necessary to leave salt areas in a virgin state. The native plants have a certain fodder value, especially the salt bushes and the Parakeelias. The trees are useful for shade purposes, but when salt bush occurs it is advisable to ringbark the trees to allow of better development of the salt bush.

Where salt areas have been cleared, cultivated and found unsuitable for crops, they should be allowed to revert to a native state. Salt Bushes may be planted, and it is advisable to commence planting from the outer edges of the affected soils.

In the wetter districts near the coast it is possible to grow certain crop plants. Sorghum, Maize and particularly Beets are found to succeed in soils which contain a certain amount of alkali.

"PERTINENT TOPICS."

G. L. SUTTON,
Director of Agriculture.

THE BLACKBERRY PEST.

Because of the presence of the Blackberry bushes at Bridgetown, Collie and elsewhere in this State, and the reports as to its rapid spread and extreme difficulty of control in New Zealand, considerable concern is felt by some in this State as to the danger which the plant is to the agriculturists of Western Australia. It is therefore opportune to examine the position.

In the first place it is important to realise that this plant does not occupy a useful or economic place in our agricultural life, on the other hand it takes control of land which could be utilised profitably for other purposes. It is an extremely hardy perennial plant which thrives without attention, does not die out, but tends to spread so that the economic loss due to its presence tends to increase rather than decrease, it is therefore *obviously advisable to prevent it becoming established on new areas and to eradicate it where it is already established.* Though this is emphatically so it is not as serious a pest, nor such a danger, as in New Zealand. On this point Mr. W. M. Carne, when Botanist and Plant Pathologist to this Department, reported:—

> Owing to our dry summer Blackberry does not spread here as it does in New South Wales and Victoria, and much less than in New Zealand. To conclude that because it is a bad weed in America, Victoria and New Zealand it will be bad in this State, is unjustified and unscientific. The more humid the summer climate the more likely the plant is to be a pest.

The Blackberry plant has been declared a noxious weed throughout Western Australia, and "The Noxious Weeds Act, 1924," provides that the local authority—Municipal Council or Roads Board—has authority to, and shall deal with this pest. Under this Act Section No. 7 provides that any local authority may give notice in writing to the owner or occupier of any land within its district to destroy any noxious weed growing or being upon such land.

There is thus ample power to eradicate this weed by any local authority who desires to do so, and the Department of Agriculture is desirous of co-operating with and supporting those who wish to take action in this connection.

The departmental experience definitely shows that this pest can be eradicated, particularly on land intended to be cultivated. There is no case known where the plant has not been completely destroyed on land required for, and placed in cultivation. To eradicate the plant, continuous and thorough treatment for more than one year, and probably for three years, is necessary. No method, including spraying with plant poisons has yet been found whereby the initial destruction of the plants above ground will also destroy all the roots; in consequence there is a re-growth, and this, unless checked, will shortly exceed the original as if the bushes has been pruned.

The method recommended for the destruction of this pest is to destroy the original bushes by cutting, slashing or spraying, and then burning them, and to follow this up by killing the re-growth shortly after it appears, so as to reduce the reserve food supply in the roots and eventually kill them. If the bushes are destroyed so that the regrowth takes place during the summer, when green feed is scarce, stock given access to it will eat the young shoots, and thus will greatly assist in the destruction of the plant. The young growth can also be destroyed by manual or horse hoeing or cultivation, and probably by burning with an oil flame thrower. Trials with this latter method are now being made at Bridgetown by Mr. T. Flintoff, Orchard Inspector. Spraying with arsenate of soda has proved effective in destroying the bushes so that they can be burnt, and it has also to a limited extent destroyed some of the roots. This spray has the disadvantage that it is poisonous, and therefore dangerous to stock when they have access to it. With the object of discovering a non-poisonous spray for the same purpose, trials are to be made at Bridgetown with calcium chlorate. Research is being undertaken elsewhere to ascertain if the Blackberry can be controlled or eradicated by biological methods, but so far no insect or disease has been found which can be liberated with safety to achieve the desired object.

The Blackberry problem in Western Australia to-day is not whether the Blackberry pest can be eradicated, but what is the cheapest method of doing so. This is the problem which is of particular interest to the Bridgetown and Collie local authorities, who have, and are making earnest efforts to eradicate the pest on the public domain within their territory.

THE "BLUE" LUPIN.

Fodder Plant and Soil Renovator.

The place which the "Blue" Lupin has made for itself in Western Australian agriculture is remarkable and probably unique. Less than 25 years ago it was an undesirable alien and regarded as a noxious weed. Under the genial Western Australian sunshine a wonderful transformation has taken place. It is now one of our most desirable and valuable introductions, with a reputation of the very best kind, and so highly is it regarded as a stock food and as a soil renovator for our lighter and less fertile lands, that instead of endeavouring to eradicate it as a noxious weed, every effort is made to encourage its more general cultivation.

So valuable is the plant now regarded that with the object of providing a stimulus for its more general and extended cultivation, West Australian Newspapers, Ltd., have generously donated prizes amounting to £1,500—the first prize £1,000—for the best 100 acres of lupins on land not previously cropped with them.

It is not surprising that in the early days of its introduction it was regarded as a noxious weed. Its reputation in Europe was enough to ensure this. As a fodder plant, it was regarded as dangerous and had to be treated with great caution because of the poisonous principle it contained. Professor Kellner, a leading authority on stock feeding, wrote:—* "Fodder from lupines has always a heating effect and in some years all parts of the plants,

* The Scientific Feeding of Animals.

seeds, straw, chaff contain a deadly poison. This is a protein-like substance probably due to a fungus, which favoured by the weather emigrates to the plant. As the poisoning is generally fatal, it is advisable to make a feeding test for a few weeks on a valueless animal (a rabbit) in order to judge if the material is safe for food. If the lupine fodder is shown to be poisonous there is nothing to be done but to steam it for 4-5 hours at a pressure of 60-80 lbs. to the square inch to destroy its poisonous properties. Simple scalding or the conversion into brown or sour hay is not sufficient to render it harmless. .. . " And again—"Good results are obtained by steeping lupine seeds, which contain a bitter principle with poisonous properties, in cold water, for otherwise only small quantities are eaten by stock. Lupine seeds are very liable to cause distension and affect the milk, either reducing the quantity or giving it a bitter taste, etc."

"To get rid of these bitter substances the lupines are soaked for 24-36 hours in cold or lukewarm water, then boiled for an hour and finally washed well with cold water, the water being changed every 6-12 hours. . ."—"Sheep eat the seeds in the natural state the most readily of all animals."

With such a bad reputation given it by one of the foremost authorities of his time, it is not surprising that West Australian stock raisers believed it to be their duty to eradicate the plant from their holdings. Fortunately the "Blue" lupin which has survived is now found, for reasons at present unknown, to be innocuous to sheep. It may be that under our bright sunlight the poisonous principle is not developed or it may be that in this particular variety the poisonous principle is either absent or present to such a lesser extent that the sheep are not injured. Because of this latter possibility it is advisable to regard varieties other than the local blue one with suspicion until they have been proved to be harmless.

The "Blue" lupin or lupine is a hardy vigorous legume which, in common with other plants of the same class, is able to utilise the free nitrogen of the atmosphere to build up its tissues and thus indirectly make it available for succeeding crops. Its hardiness enables it to thrive on poor soils. This ability to exploit our soils for their minerals and the atmosphere for its nitrogen makes it a plant of the greatest economic value, particularly for those sandy and less fertile soils in which it will thrive. As the result of its ability to collect free nitrogen from the air its value for maintaining and increasing the fertility of light lands for cultural purposes has been recognised in European countries for many years, but in this State it has in addition an equal, if not greater value, because of its ability to improve the stock-carrying capacity of such lands when their distance from railways, or when other reasons render them unsuitable for cultivation. In this connection the great value of the lupin is due mainly to the fact that the seed produced by it is readily eaten by sheep, not only without injury to them, contrary to the expectations of those with European experience, but with considerable advantage to the sheep and profit to their owner. This plant also has an additional advantage in that, except in a very early stage, it is not readily eaten by stock, when other feed is available, until the seeds have been well formed, and, in consequence, it is one of the best means, and a natural method, of conserving fodder for use in the summer months, when it is most needed because the pastures are dry and scanty. Sheep are not put amongst the lupins until some time after the seed has been shed; they find and pick up the grain and fatten on it. An average crop of lupins is estimated to fatten and maintain four sheep to the acre. It must be emphasised that its value for stock is confined to sheep. This is because the sheep can and do acquire

the habit of finding the lupin seeds on the ground and picking them up to eat them. As cattle could not do this its value for dairying or for fattening cattle is negligible.

The seed of the Blue Lupin—the common variety—does not germinate readily, and, in consequence, there may be some difficulty in first establishing a lupin patch. The advantages, however, of lupins are so great that initial failures should not deter the settler; he should persevere until he has definitely proved that either his soil or his climate is unsuitable. Once established it does not require re-seeding annually, though botanically it is an annual. Owing to the reluctance of stock to feed on the green plant, except at certain brief periods of its growth, and to the habit of the plant to distribute the seeds when ripe, the lupin is in effect perennial, with all the advantages of that group of plants, but without the serious drawback of many of them, viz., the difficulty of eradicating them if desired, as may be the case when the ground on which the lupins are growing is desired for cultivation. The fact that sheep will eat it in its early stage, and that it will not make a second growth, provides the key to its eradication. If the stock are turned in while the plants are young they will eat them, and in this way the lupins can be controlled. The lupin has, therefore, all the advantages of a perennial without its disadvantages.

The local species of lupin, which has proved so useful and valuable in this State, is called the "Blue" variety because of the deep blue colour of its flowers. It is not known how it came to Western Australia, but the agricultural species is probably a "stray" from an introduced garden plant.

The seed is flat and circular, about $\frac{3}{8}$in. in diameter and $\frac{1}{8}$in. thick. It is grey in colour with brown spots giving it a slightly speckled appearance. The brown spots are sometimes very dense, giving the seed a brownish rather than a grey appearance.

Amongst the seeds of this species there are many "hard" seeds which do not germinate readily. This is not altogether a disadvantage, for this feature ensures a second and even a later germination should the plants of the first crop, consequent upon early rains, be destroyed by succeeding hot dry weather.

The seed pods mature unevenly. Flowering commences at the top. As they mature they burst open with a cracking noise and the seeds are scattered round the plant for a considerable distance, probably up to half a chain from the parent plant.

The best way of harvesting seed is by hand picking. Over large areas this is expensive, and is rendered the more difficult owing to the fact that all the seeds are not ripe at the same time. On large areas the seed is harvested with a header, stripper or harvester, the fingers of the comb being set wide enough apart to admit the lupin stalks. When harvested in this way, it is usual to take only the earliest matured pods in the upper part of the plant, the remaining pods being left so that as they ripen the seed will be scattered on the ground for sheep feed later on.

As a good crop of lupins will produce up to 40 bushels per acre, and a small quantity only of seed is required to establish the crop, it is suggested that the best way of securing seed is to sow a comparatively small area for the purpose and to hand-pick this.

Lupins have been grown over a wide range of country in Western Australia from Geraldton in the north to Albany in the south. They are subject to injury by frost though they have escaped injury at Merredin and Nar-

rogin where heavy frosts are often experienced. The reason for this is not known, but it may be that the aspect of the land on which they were grown was a contributing factor.

For best results with the "Blue" lupin a sandy soil is necessary. On the light jam soils of the Chapman Experiment Farm the lupin flourishes abundantly; on the heavier clay loams of the Merredin Experiment Farm its growth is meagre and unsatisfactory. Though in this instance, the difference in location may have an influence, in this connection it is significant that at Merredin the plant fails to form nodules on its roots, even after the soil had been inoculated with soil from an old lupin patch. Apparently the heavy soil has an inhibiting effect upon their formation.

One method of establishing the crop for the first time is to sow the seed at the rate of from 30 to 60 lbs. per acre amongst the stubble straw of the preceding wheat or oat crop, without any previous or subsequent cultivation, but better results are likely to be obtained when the seed is covered as the result of a light cultivation. It may also be established by sowing a pound or more of seed per acre with a wheat or oat crop, the object in this case being not to provide for a full crop at once but to allow the few lupin plants which grow in the crop to mature and scatter their seed, so as to provide for a thicker self-sown crop of lupins the succeeding year.

When desired, the lupin can be grown as a special crop, and in this case the ground should be well prepared as for wheat or oats and the seed sown in drills about 3ft. apart, placing the seeds so as to provide for plants to be 12 to 18 inches apart in the drills. A thick stand of plants is not advantageous, for the seed crop is what is required and it is found that the seed production is encouraged when individual plants have plenty of room. If lupin seeds germinated readily 3 to 4 lbs. per acre would be sufficient for planting in this way, but as only a small percentage germinates at once, it is advisable to sow at least twelve pounds per acre. No special machine is required to sow the seed. It can be planted with the ordinary seed and fertiliser drill, through either the oat or wheat tubes, but preferably the former owing to its size. If desired it can be mixed with and planted with the fertiliser.

Early planting is essential for optimum results. The best time for planting is therefore early in autumn. As a matter of fact the best crops are usually those which are self-sown as the result of the seed lying on the ground throughout the summer, covered by the stock whilst grazing, and germinating with the early rains in April.

At the Chapman Experiment Farm some experiments were conducted in 1924 to determine the most suitable depth at which to plant the seed.* The germination of seeds planted one and three inches deep was compared with those planted on the surface, and the percentage germination was:—

Surface	32
One inch deep	40
Three inches deep	19

On the light jam soil known to be poor in lime and potash, other experiments carried out at the same time showed no benefits as the result of applications of 15 cwt. of lime per acre or of 35lbs. sulphate of potash. It was also found that inoculation (*i.e.*, the introduction of the nitrogen collect-

* I. Thomas, "Journal of Agriculture, W.A.," December, 1924.

ing bacteria from an old lupin patch) was unnecessary, even though the land under trial had not previously carried lupins.

In view of the results of the experiments carried out at the Chapman Experiment Farm, sowing should take place early to derive advantage from the April rains, and the seed should not be planted deeply. An application of from 100 to 150 lbs. of superphosphate (22%) should be made at the time of planting.

Though the results of the experiments at Chapman Experiment Farm were as stated on the red jam soils, it is probable that on the lighter and whiter sands both potash and lime may be necessary as well as the introduction of the necessary bacteria from an old lupin patch. This is a matter to be determined only by trial.

After planting the seed, no subsequent treatment is given the crop other than to keep the stock away from it whilst it is young.

With the object of ascertaining whether there were other varieties hardier or more prolific even than the Blue Lupin, fifty new varieties were obtained, through the courtesy of Mr. J. M. Hattrick of the Potash Supply Company, in 1924, from Germany, the European home of the lupin. Since these have become acclimatised two, pink and red flowering varieties, indicate that they are more vigorous than the local blue one. This promise requires to be confirmed, and tests made to determine whether the grain is as free from injurious substances as the tried and valuable local variety.

THE F.A.Q. WHEAT STANDARD.

The decision of the Joint Grain Sub-Committee of the Perth and Fremantle Chambers of Commerce to recommend, after consultation with the London Corn Trade Association the adoption of a permanent standard instead of the variable F.A.Q. (Fair Average Quality) one for selling our wheat crop, marks a very distinct phase in the history of our wheat industry. It is the natural evolutionary advance which is inevitable and which should be made about this time.

Following upon the very early period of the wheat industry in Australia, when the grain was sold by sample and the commercial grain did not possess the definite characters that it does to-day, the adoption of the F.A.Q. standard was a very necessary, and was at that time a very suitable method for trading in Australian wheat. With the advance of years and the gradual development of wheat having definite and distinctive Australian characteristics, the disadvantages of the variable F.A.Q. standard need be tolerated no longer.

When submitting the case to the Joint Grain Committee of the Chambers of Commerce of Perth and Fremantle, advocating the change to a permanent standard, the following reasons were advanced:—

> There is great difficulty—amounting almost to practical impossibility—to collect truly representative samples of any current harvest. Because of this difficulty the F.A.Q. standard, particularly during the past two years, has been unsatisfactory in that it did not truly represent the quality of the crop. To overcome the unsatisfactory position which obtains with regard to the last two seasons an alteration in connection with the collection of samples and the procedure has been decided upon for the current season.

Had the F.A.Q. standard of the past season been representative of the crop it would have still been unsatisfactory, for it contained only 94.5 per cent. of millable grain, and permitted 5.5 per cent. of foreign matter and screenings of little value to the purchaser. The percentage of millable grain is much lower than can be obtained with Australian harvesting machinery. Under field conditions at least 98 per cent. of millable grain can be obtained. A standard with such a low percentage discourages good workmanship on the farm, and should not receive the endorsement of the joint Chambers of Commerce as being sufficient to meet the commercial requirements of the grain trade in this State.

Because of the position which obtains under the F.A.Q. system, and which allows an unnecessarily high percentage of non-millable material, many farmers now cover up, or remove the tailing screens from their harvesters, thus deliberately lowering the commercial value of our main agricultural product by including a much larger percentage of unmillable material—foreign matter and screenings—than is necessary. How great is the economic waste which permits unnecessary non-millable material in the standard will be seen from the following figures, which show the tonnage involved in handling different percentages of the wheat exported last season, viz., 26,976,158 bushels or 722,575 tons:—

1 %	is equivalent to	7,225 tons.
2 %	„	14,450 „
3 %	„	26,675 „
(F.A.Q.) 5.5%	„	39,737 „

An additional 20 to 25 per cent. wastage is also incurred in connection with wheat transported to and handled in the flour mills.

The official recognition of an average standard—F.A.Q.—tends to increase the quantity of non-millable material. The adoption of a fixed standard would prevent this and limit the economic waste.

Theoretically the F.A.Q. standard should be representative of the whole of the State crop. The joint Chambers make a very earnest attempt to ensure that this is what the F.A.Q. standard shall be. It is, however, practically impossible to achieve this. Despite the special efforts which are being made this year the standard arrived at will not be representative of the whole of our crop, but will represent *only* the quality of the wheat exported *prior to the end of January*. It will not represent either the wheat stacked at, or being carried to, country sidings. Some of this is likely to have been harvested late in the season, and may be weathered, dull, or even bleached. Further, it is inconceivable that any disinterested person associated with the actual fixing of the standard would allow the inclusion of samples of badly bleached, sprouted, or badly smutted grain.

An annual variable F.A.Q. standard cannot be fixed until late in the season—usually about the middle of February. Normally by that time 40 per cent. or more of the crop has been shipped, and a greater percentage before the standard arrives in Great Britain. In 1923, for which year figures are available, 63 per cent. of the crop had been shipped before the F.A.Q. sample for that year had been received in

* This quantity was to 31st October, 1928. The total for the season 1st December, 1927, to 30th November, 1928, was 27,231,129 bushels.

Great Britain. Buyers overseas had thus purchased more than half our export wheat without being officially informed what they were buying. This fact was adversely commented on by the Chairman of the Liverpool Corn Trade Association.

Because of its unavoidable unsatisfactory character the Western Australian F.A.Q. sample is not regarded as seriously in Great Britain as a commercial standard endorsed by the joint Chambers should be. In this connection it has been stated by a Western Australian eye-witness that the official W.A. standard in London was labelled "W.A. F.A.Q. Standard *said to weigh* 62lbs. per bushel."

Further, because of the unsatisfactory character of the F.A.Q. standard, both shippers and overseas buyers must, in effect, make purchases and sales on the basis of what they *consider* the quality of W.A. wheat *should* be, *i.e.*, in accordance with a fixed unofficial standard based on their past experience. The following table, which gives the main characteristics of the Western Australian F.A.Q. standard since 1921-22, shows what this experience has been:—

Year.	Bushel weight.	Foreign matter.	Screenings.	Total.	Millable Grain.		
					Yearly.		Averages.
1921–22	63	·90	1·77	2·67	97·33	Average 97·16	...
1922–23	62	·88	1·55	2·43	97·57		97·45
1923–24	62¾	·40	2·51	2·91	97·09		97·33
1924–25	62½	1·08	1·92	3·00	97·00		97·24
1925–26	62	·85	2·02	2·87	97·13		97·22
1926–27	61¾	·35	2·78	3·13	96·87		97·16
1927–28	61½	·75	4·75	5·45	95·5		96·92

It is reasonable to suppose that if buyers were dealing on a definite basis, as in the case of a fixed official standard, they would be prepared to pay the top price for wheat of that standard quality, which would obviously be a better price than when buying on a basis which is indefinite, and when, in consequence, unknown contingencies have to be provided for.

Variable standards are not endorsed by political leaders, nor are they in accordance with modern commercial practice. At a recent Premiers' Conference the following resolution was passed:—

> That this Conference is strongly of the opinion that it is undesirable to lower established standards of export products to meet temporary or seasonal conditions, and that the Commonwealth Government be informed accordingly.

For some time there have been fixed standards for apples and pears, and no variations are allowed to meet the peculiarities of particular seasons. After serious consideration, and in the light of experience, dried fruit growers have adopted—as far as is possible—permanent standards. The only reason they are not absolutely permanent is because of the difficulty in finding a suitable permanent material (like wax or plasticine) in which to model permanent replicas of the standards desired. No such difficulty exists with regard to wheat.

In Western Australia there is a fixed standard for oats known as "The W.A. Standard Feed Oats." Its description is:—

W.A. Standard Feed Oats shall be bright, sound and free from musty, smutty or other objectionable smell. It shall contain by weight not less than 96 per cent. of oats; not less than 14 per cent. of prime oats, and not more than 6 per cent. of screenings oats; nor shall there be more than 1/20th per cent. by weight of the seeds of "Speargrass." The bushel weight shall not be less than 37 lbs.

Already there is one fixed standard for wheat in use in this State. This is known as the "W.A. Standard White." It was forced into existence by the requirement of certain sections of the export trade. It has been in use for Government certificated cargoes each year for the past five years from the opening of the season until the fixing of the F.A.Q. standard by the joint Chambers. Last season 7,546,116 bushels (202,128 tons), or 28 per cent. of the export wheat, was shipped according to this fixed standard, and in 1924 the proportion of the crop shipped under Government certification prior to the fixing of the F.A.Q. standard was 61.3 per cent.

The United States of America and Canada have adopted permanent standards, despite the different types of wheat grown in those countries. In Western Australia (and Australia) there is only one type, and therefore the need for one standard. Such a standard should be agreed upon and recognised officially by the joint Chambers. It is not suggested that it should be the present W.A. standard or any particular one.

Two main factors will decide what the standard should be. These are—

The percentage of millable grain; and
The weight per bushel.

For several consecutive years the Western Australia F.A.Q. standard was the highest in the Commonwealth, and in consequence became of high repute on the overseas markets. This reputation can be better maintained by the adoption of a fixed standard rather than by a continuance of the present variable F.A.Q.

Just as the F.A.Q. system supplanted a less suitable one, so it is believed that, because of our greater expansion, it is now desirable that our present F.A.Q. standard, which has served its turn, should give place to a more modern one of trading according to permanent standards, a system which is more in keeping with the march of standardisation, and which will bring the Australian system in line with the other great wheat producing countries of Canada and the United States of America.

The decision in favour of a permanent standard is in accordance with modern commercial practice. Its usefulness is analagous to that of a foot rule with its recognised definite standards of measurement. Tanning extracts are bought and sold according to the percentage of tannin they contain, likewise our wool is sold according to the quantity and quality of the clean wool fibre it contains. What is more reasonable than that our wheat should be sold according to the quantity and quality of the millable grain it contains.

Not many years ago, in parts of Western Australia, wool was bought "all in," which is similar to buying wheat according to the variable F.A.Q. standard. It would be difficult to induce those who are accustomed to selling their wool according to the permanent standard of quantity and quality to revert to the old method.

The proposed permanent standard is very similar to that of the F.A.Q. standard fixed, in any year, for several years past. A comparison with the proposed standard and the present F.A.Q. (1928-29) is as follows:—

F.A.Q. STANDARD.		W.A. STANDARD WHITE WHEAT.	
The Grain to be Sound and fit for Shipping.		*The Grain to be Sound and fit for Shipping.*	
Quantities:—		*Quantities*:—	
Bright and Sound Grain ..	95.1%	Bright and Sound Grain ..	95.5%
Total Milling Grain ..	97 %	Total Millable Grain ..	97 %
Total Foreign Matter ..	3 %	Total Foreign Matter ..	3 %
Bushel Weight—62½ lbs.		*Bushel Weight of Cleaned Grain*—62 lbs.	

The adoption of the permanent standard will in no way interfere with or disorganise existing methods of dealing with the grain crop. The present method of buying from farmers by sample, and according to the judgment of the agent, will continue; but, because of an accurate definition of what the standard consists, the adjustment of differences in the case of disputes, either overseas or in the State, can be settled by skilled judgment with less difficulty than in the past.

The proposed standard conforms to the conditions believed to be necessary. It denotes the Australian character of our wheat and states its quality, and further it is distinctive and simple.

Though the wheat grower is the one most concerned financially in the fixing of commercial trading standards for the sale of his crop, millers and wheat merchants are also interested. It is, therefore, considered desirable that they, as well as the grower—because changes in established methods should be made with discrimination—ought to be consulted before the details of any standards are finally decided upon. The decision of the Chambers of Commerce to consult the London Corn Trade Association as representing the overseas buyers before the final details of the standard are decided is therfore desirable, sound, and reasonable. Though there may be some difference of opinion as to details it is difficult to conceive of any objection that can be raised against the logical introduction of a permanent trading standard. None so far have been raised though there is the usual natural disinclination to make any change, but in this case, as has been shown there is little or no alteration in existing methods. There is simply the official recognition of a standard which the merchants have been compelled to use, consciously or unconsciously during the early part of every season. It is expected that the proposed permanent standard will be welcomed, for the advantages of having a permanent standard are so obviously greater than working according to a variable one. These advantages are summed up in a report of a former Secretary of the United States Department of Agriculture, who wrote:—

Federal grain standardisation, by establishing a uniform basis for interstate trading, lessens the chances of misunderstandings and disputes, gives confidence to buyers and sellers, and facilitates business at every stage in the movement of grain from the farm to consuming centres. It thus tends to reduce distribution costs, and reduction of distribution costs is of practical value to the farmer at any time. It is especially useful to him in times of low prices when inefficient distribution may saddle him with an intolerable burden of expense.

YILGARN DISTRICT CROP COMPETITION.

Judge: G. K. STEVENS,
Manager, Yilgarn Experiment Farm.

The settlers of the Yilgarn district are to be congratulated on again conducting a crop competition during the past season. Fifteen entries were received, Corinthia, N.W. Bullfinch, N.E. Bullfinch, and Moorine Rock being represented. It is pleasing to note that wider interest is being taken in the competition, which was divided into two sections, one for crops grown on fallowed land and the other for crops grown on unfallowed land. The area for competition was 50 acres instead of 10 acres as was the case the previous year.

The following awards were made:—

YILGARN DISTRICT CROP COMPETITION, 1928 (50 ACRES).

Judge: G. K. Stevens, Manager, Yilgarn Experiment Farm.

FALLOWED SECTION.

Name	Address.	Variety.	Yield. 40 points.	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth 10 points.	Total. 100 points
Basenger Bros.	N.E. Bullfinch	Gluyas Early	19	18	13	14	9	73
Cass-Smith, W. P.	N.W. Bullfinch	Gluyas Early	17	18	14	14	9	72
Pickworth, W. (No. 1)	Moorine Rock	Gluyas Early	18	18	14	14	8	72
Jukes, J. ...	N.W. Bullfinch	Nabawa ...	19	18	14	11	8	70
Mason, C. ...	N.E. Bullfinch	Gluyas Early	20	16	14	12	8	70
Bamber, W. ...	N.W. Bullfinch	Gluyas Early	16	17	14	13	9	69
Copley, N. ...	N.W. Bullfinch	Gluyas Early	15	17	14	14	8	68
Copley, C. ...	N.W. Bullfinch	Nabawa ...	14	16	14	13	7	64
Pickworth, W. (No. 2)	Moorine Rock	Nabawa ...	16	15	14	12	7	64

UNFALLOWED SECTION.

Name	Address.	Variety.	Yield.	Freedom from Weeds.	Freedom from Disease.	Freedom from Admixture.	Evenness of Growth	Total.
Davies, F. & J.	Corinthia ...	Gluyas Early	14	18	14	14	9	69
Carstairs & Liddell	Moorine Rock	Nabawa ...	17	17	14	12	8	68
Pickworth, W. (No. 3)	Moorine Rock	Nabawa ...	12	17	14	14	8	65
Bamber, Mrs. W.	N.W. Bullfinch	Gluyas Early	10	18	14	14	8	64
Kent, R. ...	N.W. Bullfinch	Gluyas Early	7	18	13	14	9	61
Stopher, R. ...	Corinthia ...	Gluyas Early	8	18	13	13	7	59

The winning crop on fallow was grown by Basenger Bros., of N.E. Bullfinch. This was an even crop of good height. Although the heads were not numerous they were well developed.

In the unfallowed section the crop of F. and J. Davies secured first place. This was grown on heavy Salmon Gum and Gimlet country. The crop of Mr. Carstairs, of Moorine Rock, although yielding better, lost points owing to weed growth and the presence of admixture, and was not so even in height. The land had been cleared of scrub by being ploughed with a disc implement.

Bearing in mind the adverse growing conditions which were experienced in this area, the yields obtained are surprisingly good. The average yield for those crops on the fallowed land was 17.1 bushels, and for those on unfallowed land 11.1 bushels. Being new, or comparatively new land, the crops were fairly free from weeds. In a few cases salt bush and small scrub were present. Generally the crops were fairly free from admixture, but in several cases barley was present to a slight degree, and in one case very prevalent. In three crops only was disease present, and in each instance it was a trace of Ball Smut. In the majority of crops the growth was fairly even.

The rainfall, as officially recorded at Southern Cross and Bullfinch, is given below:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
Southern Cross	95	...	56	23	130	71	156	100	45	17	519	...	...	..
Bullfinch	141	...	51	53	110	74	192	83	60	61	580	3	64	892

The details of the cultural methods of the competitors are as hereunder:—

YILGARN DISTRICT CROP COMPETITION.

FALLOWED SECTION.

Competitor.	Basenger Bros.	Cass-Smith, W. P.	W. Pickworth (1)	J. Jukes.
Years cropped ...	First	Second	First	First
Timber	Salmon, Gimlet scrub	Mallee	Morrel	Salmon, Gimlet, Morrell
Ploughed	August	May, 1927	August	June
Type of plough ...	Sundercut	Gaston disc	Sundercut	Gaston disc
Depth	3½ to 4in.	4½ to 5in.	2½in.	5in.
Condition of land at time of ploughing	Bit dry	Good	Good	Good
Other cultivations	Combined in	Cross ploughed in July with Sundercut 3in. Cultivated Sept. 2½ to 3in. after 4in. rain. Combined in	Sundercut in August. Combined in	Cultivated in September before seeding. Combined in.
Variety	Gluyas Early	Gluyas Early	Gluyas Early	Nabawa
Planted	16th May	13th May	18th May	9th May
Rate of Seed ...	30lbs.	30lbs.	30lbs.	26lbs.
Graded	No	Yes	Yes	No
Treated	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of Super ...	30lbs.	50lbs.	60lbs.	56lbs.
Disease	Smut	*Nil*	*Nil*	*Nil*

YILGARN DISTRICT CROP COMPETITION.—CONTINUED.

FALLOWED SECTION—*continued.*

Competitor.	Mason.	Bamber, W.	N. Copley.	C. Copley.	W. Pickworth (II).
Years cropped	First	First	Third	Second	Third
Timber ...	Salmon, Gimlet, Jam	Salmon, Gimlet Scrub	Salmon, Gimlet, Mallee	Salmon, Gimlet	Gimlet
Ploughed ...	June	August	June	July	September
Type of plough	Sundercut	Sundercut	Sundercut	Sundercut	Sundercut
Depth ...	3in.	3½in.	4in.	4in.	3in.
Condition of land at time of ploughing	Good	Good	Good	Good	Good
Other cultivations	Combined in	Combined in o	Sundercut in Sept. after 4in. rain. Combined in	Sundercut after 4in. rain in Sept. Combined in	Sundercut Oc Combined in
Variety ...	Gluyas Early	Gluyas Early	Gluyas Early	Nabawa	Nabawa
Planted ...	8th May	5th May	12th May	9th May	3rd May
Rate of Seed	36lbs.	30lbs.	30lbs.	25lbs.	30lbs.
Graded ...	No	Yes	Yes	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of Super	40lbs.	40lbs.	55lbs.	55lbs.	70lbs.
Disease ...	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*

NON-FALLOWED.

Competitor.	F. & J. Davies	Carstairs and Liddell.	W. Pickworth (III)	Mrs. Bamber.	R. Kent.	R. Stopher.
Years cropped	Second	First	Third	First	Second	First
Timber ...	Salmon and Gimlet	Sand plain, low quality	Gimlet and Morrell	Mallee and Jam	Morrell, Gimlet Jam	Salmon and Gimlet
Ploughed ...	...	October	No	Before seeding	...	...
Type of Plough	...	Shearer disc	...	Sundercut	...	...
Depth ...	...	3in.	...	2½ to 3in.	...	...
Condition of land at time of ploughing	...	Good	...	Good	...	...
Other cultivations	Cultivated in March, combined in	Combined in	Cultivated in April, combined in	Combined in	Cultivated in March, combined in	Combined in
Variety ...	Gluyas Early	Nabawa	Nabawa	Gluyas Early	Gluyas Early	Gluyas Early
Planted ...	9th May	26th April	10th May	16th May	9th May	26th May
Rate of Seed	34lbs.	26–45lbs.	25lbs.	30lbs.	33lbs.	30lbs.
Graded ...	Yes	Yes	Yes	Yes	Yes	No
Treated ...	Dry	Dry	Dry	Dry	Dry.	Wet
Rate of Supor	65lbs.	90lbs.	45lbs.	40lbs.	60lbs.	45lbs.
Disease ...	*Nil*	*Nil*	*Nil*	*Nil*	Smut	Smut

CORRIGIN DISTRICT CROP COMPETITION.

Judge: G. L. THROSSELL, Dipl. Agric.,
Agricultural Adviser.

The crop competition conducted by the Corrigin Agricultural Society was a local one. It was judged under the same conditions and the same scale of points as those of the Royal Agricultural Society's Crop Competitions.

Nine entries in all were received, six of which were submitted for inspection.

The rainfall for 1928 recorded up to the end of October is shown in the following table. Although the rainfall towards the end of the season fell in rather light showers, and the season "cut off" early, the rainfall was sufficient to grow good crops. Had good rains fallen in October, much heavier yields could have been expected.

—	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total. May to Oct.
Kurren-Kutten ...	75	...	...	35	197	107	473	265	111	55	1,208
Corrigin	98	...	19	68	146	85	434	279	124	66	1,134

The points awarded to the various competitors are as follow:—

CORRIGIN DISTRICT AGRICULTURAL SOCIETY.

50-ACRE CROP COMPETITION, 1928.

ZONE 7.

Judge: G. L. Throssell, Agricultural Adviser.

Competitor.	District.	Variety.	Estimated Yield. 40 points	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Bremner, J. R. & Son	Kurren-Kutten	Gluyas Early	28	19	13	14	9	83
Bartlett, Arthur	Gorge Rock	Dollar ...	24	19	11	13	7	74
Taylor, J. B....	Kunjin ...	Gresley ...	20	19	12	11	8	70
Cronin, J. ...	Kurren-Kutten	Nabawa ...	18	17	11	12	8	66
Ding, J. B. ...	Corrigin ...	Ford ...	12	19	13	14	8	66
Evans, M. ...	Kunjin ...	Minister ...	16	17	12	12	7	64

Messrs. J. R. Bremner & Sons, of Kurren-Kutten, gained first place with 83 points, with a splendid crop of Gluyas Early, which was calculated to yield 28 bushels per acre. This crop easily surpassed those of the other competitors, and is an example of what can be done with good farming methods. Planted with a "combine" on well-worked fallow, the variety Gluyas Early was sown on 22nd and 23rd May at the rate of 45 lbs. of graded and dry-pickled seed, with 100 lbs. of superphosphate per acre. The crop had stooled well, was very even and dense, and of a convenient stripping height. This entry was very true to type, and the fact that only one or two

"strangers" were found shows the carefulness of the farming operations. There was a slight infection of "Take-all," and it was only on these patches that the very little weed growth was noticed.

The crop of "Dollar" entered by Mr. Arthur Bartlett, of Gorge Rock, was awarded second place with 74 points. This entry was not as even as the winning crop, but was well headed and was calculated to yield 24 bushels per acre. It was very free of weeds, but was rather badly infected with "Take-all." Loose smut was also evident, as well as a trace of both Bunt and Flag Smut. It was free of barley, but had a small admixture of foreign ears.

The following table summarises the cultural methods of the competitors:—

CORRIGIN DISTRICT CROP COMPETITION.

Competitor.	J. Bremner & Sons.	Arthur Bartlett.	J. B. Taylor.	J. Cronin.	J. B. Ding.	M. Evans.
Years cropped	Four crops	Five crops	...	Three crops	First crop	Two crops
Rotation ...	2 years. Fallow, crop	2 years. Fallow, crop	2 years. Fallow, crop	2 years. Fallow, crop.	...	3 years. Fallow, crop, stubble
Timber ...	Gimlet and tea-tree	Jam, York, and Salmon	Salmon and York Gum	Gimlet, Boree and Morrell	Sand plain	Salmon, White Gum and Jam
Ploughed ...	Early June	Middle June	Late August	Late June	End August	Late June
Type of Plough	Sundercut	Mouldboard	Mouldboard	Disc	Cultivating Disc	Mouldboard
Depth ...	3ins.	6ins.	4ins.	3½ins.	4ins.	4½ins.
Condition of land at time of ploughing	...	...	...	...	...	...
Other cultivations	Tandem disced (on account of self sown) in Aug. Springtyned to full depth in Sept. Harrowed end of Sept., scarified in Oct.	Springtyned early in Sept. to full depth. Cultivated twice (crossed) with springtyne in March	No cultivations. Small strip tandem disced in March	Springtyned to full depth beginning Aug., again in Sept. In patches (weeds) in Oct.. Again prior to seeding	Harrowed in March	Harrowed in July. Scarified in Sept. Harrowed end of Sept.
Variety ...	Gluyas Early	Dollar	Gresley	Nabawa	Ford	Minister
Planted ...	22nd and 23rd May	1st week May	End May	End April, beginning May	End April	Early April
Type of Drill	Combine	Disc	Combine	Disc	Disc	Hoe
Rate of Seed	45lbs.	60lbs.	60lbs.	50lbs.	45lbs.	30lbs.
Graded ...	Yes	Yes	Recleaned	Yes	Yes	No
Treated ...	Dry pickled	Dry pickled	Dry pickled	Formalin	Dry pickled	No
Rate of Super	100lbs.	90lbs.	90lbs.	70lbs.	95lbs.	120lbs.
Disease ...	Takeall. Trace of Flag Smut	Takeall. Loose Smut. Traces Flag Smut and Bunt	Takeall. Traces Loose Smut. Flag Smut and Septoria	Takeall. Loose Smut and Traces of Bunt	Trace Takeall and Septoria	Takeall. Septoria Loose Smut, Stem Rust and Trace Flag Smut

PHILLIPS RIVER DISTRICT CROP COMPETITION.

Judge: A. S. WILD, B.Sc. (Agric.),
Agricultural Adviser.

The Phillips River Agricultural Society, in holding a crop competition during 1928, has taken a step well worthy of the district. The settlers in this locality are to be congratulated for the zeal which, undeterred by the vicissitudes of the season, prompted them to proceed with their intentions and surmount some of the difficulties arriving through their isolation from the other wheat-growing districts. It is confidently expected that, by a participation in this, and eventually in the Royal Agricultural Society's Fifty Acre Crop Competition, the farmers of the district will be assisted in gaining knowledge and further experience in wheat culture, and that the town of Ravensthorpe will become a striking example of the metamorphosis of Mining to Agriculture.

The conditions of the competition were that the areas inspected were to be at least 25 acres in extent, planted with the one variety, and judged under the scale of points applying to the Royal Agricultural Society's Crop Competitions.

Ten competitors submitted crops for inspection by the Judge, the awards being as follow:—

PHILLIPS RIVER DISTRICT CROP COMPETITION.

Judge: A. S. Wild, Agricultural Adviser.

Competitor.	District.	Variety.	Yield. 40 points	Freedom from Weeds. 20 points.	Freedom from Disease. 15 points.	Freedom from Admixture. 15 points.	Evenness of Growth. 10 points.	Total. 100 points.
Bebbington, H.	Ravensthorpe	Yandilla King	17	19	14	13	8	71
Smith, W. H.	Kuliba ...	Nabawa ...	17	19	13	13	8	70
Reynolds, W. E.	Ravensthorpe	Nabawa ...	15	18	14	14	8	69
Barrett Bros....	Ravensthorpe	Merredin ...	14	18	14	14	8	68
Chapman, J. J.	Kuliba ...	Nabawa ...	13	19	14	13	9	68
Chambers Bros.	Ravensthorpe	Merredin ...	15	17	13	13	8	66
Blake, J. ...	Ravensthorpe	Merredin ...	9	19	14	13	7	62
Buckie, H. ...	Ravensthorpe	Yandilla King	10	18	14	12	7	61
Dasborough, S. C. B.	Ravensthorpe	Nabawa ...	8	19	13	14	7	61
Daw, F. E. ...	Ravensthorpe	Nabawa ...	8	19	14	13	7	61

The winning crop was that of Mr. H. Bebbington, the variety being "Yandilla King," calculated to yield 17 bushels per acre. The land, cropped for the first time, had been ploughed with a disc plough to a depth of 2 inches to 3 inches the previous June. Further working consisted in its being skim ploughed with a disc implement during the month of November and again immediately before drilling. The crop was planted during the second week in May with 45 lbs. per acre of graded seed which had been treated with copper carbonate for the prevention of Ball Smut. Superphosphate was applied at seeding at the rate of 75 lbs. per acre.

This crop was very free of disease and weeds. It lost points for admixture, barley being prevalent throughout, as well as a few plants of strange varieties of wheat.

Mr. W. H. Smith's crop of "Nabawa," which was placed second, was grown on scrub plain country within about 10 miles from the coast towards Hopetoun. It was planted with 60 lbs. per acre of graded seed, with an application of 90 lbs. of superphosphate per acre on land which had been ploughed for this, its first crop, the previous July. This crop, calculated to

yield 17 bushels per acre, lost points for disease (traces of Flying Smut and Ball Smut). It was fairly free of weeds and admixture.

The monthly rainfalls for 1928, together with the average rainfalls for both Ravensthorpe and Hopetoun, are given below:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total			
Ravensthorpe, 1928	114	17	181	52	95	65	198	229	91	45	723	48	27	1,162
Ravensthorpe, Average	53	77	135	146	173	152	188	173	161	171	1,018	100	115	1,644
Hopetoun, 1928	157	2	103	139	174	119	373	186	139	59	1,050	38	26	1,515
Hopetoun Average	53	73	145	166	253	248	265	228	196	175	1,365	101	109	2,012

In common with other portions of the wheat belt, the Phillips River area suffered through the spasmodic rainfall of the season, October being particularly dry. Consistent drying winds during the growing period were responsible for much evaporation of moisture, the loss of which could be ill afforded. In years of normal rainfall it is anticipated, that this district will, with correct methods of cultivation, grow crops which will compare favourably with those of other portions of the wheat belt having similar classes of soil.

The table given below summarises the methods of cultivation at present adopted by the competitors:—

PHILLIPS RIVER DISTRICT CROP COMPETITION.

Competitor ...	Bebbington, H.	Smith, W. H.	Reynolds, W. E.	Barrett Bros.	Chapman, I. J.
Years cropped	First crop	First crop	Second crop	First crop	First crop
Timber ...	Mallee, Mort, Mallet and some Gimlet	Scrub plain	Mallee scrub, plain of fair quality	Gimlet and Mallee, red loamy soil	Scrub and blue mallee, plain country
Ploughed ...	July	July	Late August	July	July
Type of plough	Disc	Disc	Mouldboard	Mouldboard	Disc
Depth ...	2 to 3ins.	4ins.	4ins.	3½ to 4ins.	3ins.
Condition of land at time of ploughing	Varying	Good	Fair	Dry	Good
Other cultivations	Skim ploughed with disc implement in Nov. and again before drilling	Cross-disced to a depth of 3 inches in Mar. Disc harrowed in front of drill	Springtyne cultivated in Sep. and again in Oct.	Disc-cultivated after Oct. rains and again just before drilling. Portion drag harrowed behind drill	Cross-disced to a depth of 2½ to 3 ins. Mar. disc harrowed in front of drill
Variety ...	Yandilla King	Nabawa	Nabawa	Merredin	Merredin
Planted ...	Second week in May	Middle of June	Middle of May	3rd week in May	End of May
Rate of Seed...	45lbs.	60lbs.	45lbs.	55lbs.	60lbs.
Graded ...	Yes	Yes	No	Yes	Yes
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of Super	75lbs.	90lbs.	60lbs.	82lbs.	113lbs.
Disease ...	...	Traces of Flying Smut and Ball Smut	Trace of Flying Smut	Trace Septoria	Traces of Flying Smut and Septoria

PHILLIPS RIVER DISTRICT CROP COMPETITION—*continued.*

Competitor ...	Chambers Bros.	Blake, J.	Buckie, H.	Dasborough, S. C. B.	Daw, F. E.
Years cropped	About 9th crop	3rd crop	3rd crop	2nd crop	1st crop
Timber ...	Salmon and Gimlet	Mallee and Gimlet, heavy red soil	Mallee, Salmon Gum and Yate	Gimlet and Mallee. Fluffy soil	Mallee
Ploughed ...	June and July	Half in June and half in Feb.	End of May	Early June	
Type of plough	Mouldboard	Mouldboard	Springtyne cultivator	Disc	Disc
Depth ...	3½ to 4in.	3½in.	2in.	2½in.	
Condition of land at time of ploughing	Good	Good in June, but dry in March	Fair	Good	Wet
Other cultivations	Harrowed twice and Springtyne cultivated twice in Sring. Springtyne cultivated in autumn and harrowed immediately prior to seeding	June ploughing, harrowed in June, Springtyne cultivated in July and Sept. and all Springtyne cultivated before drilling	Drilled with combine in opposite direction to previous cultivation	Disc-harrowed immediately prior to seeding	Cross-ploughed with disc implement and Springtyne cultivated
Variety ...	Merredin	Merredin	Yandilla King	Nabawa	Nabawa
Planted ...	Middle of May	End of June	6th June	End of June	
Rate of Seed	60lbs.	60lbs.	43lbs.	73lbs.	50lbs.
Graded ...	Yes	Yes	No.	No.	
Treated ...	Dry pickled	Dry pickled	Dry pickled	Dry pickled	Dry pickled
Rate of Super	65lbs.	96lbs.	70lbs.	90lbs.	56lbs.
Disease ...	Traces of Flying Smut, Flag Smut and Septoria	...	...	Septoria	...

It is pleasing to note the competitors paid particular attention to the treatment of their seed; all treated their seed wheat with copper carbonate for the prevention of Ball Smut, and the majority graded their seed.

The rates of seeding varied from 45 lbs. to 73 lbs. per acre. The latter quantity is excessive, particularly with the freer stooling varieties such as "Nabawa." Experiments conducted at the different experiment farms have shown that amounts greater than 60 lbs. per acre are neither necessary nor economical.

The varieties planted by the competitors are undoubtedly worthy of favourable comment. They are limited to "Yandilla King," "Nabawa" and "Merredin," all of which are considered suitable for the district.

Regarding wheat varieties, it should not be overlooked that timely seeding is a most important factor. The general maxim is to plant late varieties early, and early varieties late. A general recommendation to the settlers of this district is to plant a late variety such as "Yandilla King" at the end of April and up to the middle of May, a mid-season variety such as "Nabawa" during the month of May, and an early variety such as "Merredin" towards the end of May, the main "seeding" month.

Experiments have demonstrated that, for light country, late and mid-season varieties planted early are more profitable than early varieties planted late.

The preparation of the seed bed is a subject which has demanded—and received—much patient inquiry, research, and demonstration. It has been established that four inches is sufficient depth to plough, the class of soil determining the type of plough (disc or mouldboard) to use. It must be remembered, however, that whatever type of implement be used the work should be done thoroughly.

Experiment results show that higher yields are obtained from land which has been fallowed during the early winter months than that ploughed later in the fallowing season. The cultivation immediately following the initial ploughing should be deep, and preferably with a springtyne implement so that the clods are brought to the surface, allowing the finer soil to form a consolidated seed bed below. It is unwise, however, to cultivate deeply during the summer and autumn months. The use of the disc cultivating implement during the months prior to seeding should be avoided unless the condition of the land at that time demands a heavier implement than the springtyne cultivator. Should the use of a disc implement be necessary, care should be taken not to cultivate too deeply.

It is expected that the next crop competition of the Phillips River Agricultural Society will be for an area of 50 acres, planted on fallowed land, and that the competition will become associated with the Royal Agricultural Society's competition which has done so much to assist the progress of wheat growing in this State.

VARIATION IN WEIGHT OF EGGS.

W. T. RICHARDSON,
Poultry Adviser.

It is contended in some quarters that there is little variation in the weight of eggs laid by individual birds if they produce the standard grade egg four or five months after commencing to lay, *e.g.*, 2 ozs. (24 ozs. to one dozen eggs); hence it becomes unnecessary to weigh eggs individually. Following the above line of reasoning one would naturally conclude that an average of 2 ozs. attained during, say, July and August would ensure a similar average for the remaining months of the laying season.

To demonstrate how erroneous this impression is the following figures have been taken from records of performances obtained at Muresk Egg Laying Competition, where every egg laid is weighed. The records under review have been taken from two different tests, so that seasonal influences may not be held responsible for the variations noted. These examples have been

selected from a number of similar ones. Naturally, in some cases the variation in weight is more pronounced than in others.

VARIATION IN WEIGHT OF EGGS LAID BY INDIVIDUAL BIRDS AT MURESK EGG-LAYING COMPETITION.

1ST TEST—FROM 10TH APRIL, 1927, TO 31ST MARCH, 1928.

NOTE :—24ozs. to 1 doz. eggs = 2oz. egg.

Month.	Bird No.	Ounces to 1 dozen eggs.												
		30.	29.	28.	27.	26.	25.	24.	23.	22.	21.	20.	19.	18.
April	1 W.L.	...	...	...	...	...	...	1	3	6	2	3	...	...
May	"	...	...		moult.			...	...	...	1	...	...	...
June	"	1	...	...	...	6	7	3	...	...	...	...	...	...
July	"	...	...	2	2	9	8	1	...	...	...	...	...	...
August	"	...	...	...	3	7	11	4	...	...	...	...	...	...
September	"	...	...	1	4	2	8	8	1	...	...	...	...	...
October	"	...	...	...	...	2	2	5	16	5	...	...	...	...
November	"	...	...	...	...	...	...	...	4	13	12	...	...	...
December	"	...	...	...	...	...	...	...	2	5	16	3	3	...
January	"	...	...	...	...	...	...	7	5	6	5	2	...	...
February	"	...	...	...	...	...	3	5	12	1	...	...	...	...
March	"	...	...	...	...	...	3	4	2	...	...	...	...	...
April	3 W.L.	...	...	...	...	...	...	1	2	5	4	...	...	...
May	"	...	...	...	...	2	8	7	4	...	1	...	...	...
June	"	...	...	6	2	7	4	1	...	...	...	...	...	...
July	"	...	...	6	4	9	2	...	...	...	...	...	...	...
August	"	...	...	...	3	5	10	3	...	...	1	...	...	...
September	"	...	...	1	...	2	5	18	1	...	...	...	...	...
October	"	...	...	...	1	...	2	11	9	2	...	...	...	1
November	"	...	...	...	...	...	1	6	14	4	2	...	...	...
December	"	...	...	...	...	...	1	6	9	5	3	...	...	...
January	"	...	...	...	...	2	2	5	8	5	3	...	...	...
February	"	2	...	...	...	...	3	10	5	...	1	...	...	...
March	"	1	...	1	2	...	5	1	7	3	...	...	...	2
April	5 W.L.	...	...	...	...	...	...	...	2	...	2	1	...	1
May	"	...	...	...	...	...	...	8	6	...	...	...	...	...
June	"	...	...	...	2	4	10	2	...	1	...	...	...	...
July	"	...	...	1	3	6	6	2	1	...	...	...	...	...
August	"	...	...	...	2	14	8	...	...	...	...	...	...	...
September	"	...	...	...	4	8	11	1	...	...	...	...	...	...
October	"	...	...	...	...	5	9	5	1	2	...	...	...	...
November	"	...	...	...	...	2	11	9	2	...	...	...	...	...
December	"	...	...	...	...	...	5	10	8	2	...	...	...	...
January	"	...	...	...	...	...	10	11	3	...	...	...	...	...
February	"	...	...	...	1	4	8	11	...	...	...	...	...	...
March	"	...	...	1	3	3	9	5	1	...	...	...	...	...
April	19 B.O.	...	...	...	...	...	...	...	2	7	4	2	1	...
May	"	...	...	...	...	...	2	4	15	2	...	...	...	...
June	"	...	...	...	1	2	7	13	...	...	...	...	...	...
July	"	...	...	...	...	7	11	6	...	...	...	...	...	...
August	"	...	...	...	...	5	12	7	...	...	...	...	...	...
September	"	...	...	...	...	6	6	7	4	...	...	...	...	...
October	"	...	...	...	...	4	9	8	5	...	...	...	...	...
November	"	...	...	...	...	5	5	7	6	1	...	...	...	...
December	"	...	...	...	...	...	7	6	7	...	...	...	...	...
January	"	...	...	...	...	1	4	6	9	1	...	...	...	...
February	"	...	...	...	...	1	6	5	7	2	...	...	...	...
March	"	...	...	...	...	1	...	...	...	...	...	...	...	1
April	36 B.O.	...	...	...	...	...	...	...	2	2	1	1	...	...
May	"	...	...	...	...	...	9	9	3	...	...	...	...	...
June	"	...	...	...	...	4	13	3	...	...	...	...	...	...
July	"	...	...	...	...	7	10	1	...	...	...	...	...	...
August	"	...	...	...	3	11	5	2	...	...	...	...	...	...
September	"	...	...	1	...	5	13	2	...	...	...	...	...	...
October	"	...	...	...	...	2	12	9	3	...	...	...	...	...
November	"	...	...	...	...	...	...	13	7	4	...	...	...	...
December	"	...	...	...	...	1	2	2	4	2	...	1	...	...
January	"	...	...	...	...	...	4	11	3	...	1	...	...	...
February	"	...	...	...	...	1	3	14	5	...	...	...	...	...
March	"	...	...	...	...	1	4	12	3	2	...	...	...	...
April	70 B.O.	...	...	...	...	...	...	...	5	5	4	2	...	...
May	"	...	...	...	...	...	...	6	7	2	...	...	...	...
June	"	...	...	...	1	2	5	1	2	1	...	...	...	...
July	"	...	...	4	2	11	6	...	...	...	...	...	...	...
August	"	...	...	...	4	12	7	...	...	...	...	...	...	...
September	"	...	...	4	2	10	5	3	...	...	...	...	...	...
October	"	...	...	1	1	3	6	13	3	...	...	...	...	...
November	"	...	...	1	...	2	7	8	4	1	1	...	...	...
December	"	...	...	...	...	...	3	6	6	7	1	...	...	...
January	"	...	...	...	...	1	...	8	3	10	4	...	...	...
February	"	...	...	...	...	2	3	8	9	1	...	...	...	...
March	"	...	...	1	2	1	6	10	3	...	...	...	...	...

VARIATION IN WEIGHT OF EGGS, ETC.—FIRST TEST—*continued.*

Month.	Bird No.	Ounces to 1 dozen eggs. 30.	29.	28.	27.	26.	25.	24.	23.	22.	21.	20.	19.	18.
April	74 B.O.	...	...	...	...	...	...	...	...	...	1	2	6	1
May	"	...	...	...	...		mo	ult.		...	...	...	...	...
June	"	...	...	...	1	...	6	7	3	3	...	...	...	...
July	"	...	...	...	...	...	1	7	8	1	...	...	...	...
August	"	...	...	...	...	...	8	14	3	...	...	...	...	...
September	"	...	...	...	...	...	2	13	12	1	...	...	...	...
October	"	...	...	...	...	...	1	5	15	7	1	...	...	...
November	"	...	...	...	...	...	1	1	8	11	4	1	...	...
December	"	...	...	...	...	...	...	2	3	15	4	...	...	...
January	"	...	...	...	...	...	...	1	10	12	5	...	...	...
February	"	...	...	...	...	...	...	...	13	2	...	...	...	...
March	"	...	...	...	...	1	7	6	2	1	...	...	...	...

2ND TEST.—FROM 10TH APRIL, 1928, TO 10TH FEBRUARY, 1929.

(Concludes 17th March, 1929).

Month.	Bird No.	Ounces to 1 dozen eggs. 30.	29.	28.	27.	26.	25.	24.	23.	22.	21.	20.	19.	18.
April	9 W.L.	...	...	...	...	...	...	...	6	2	2	1	...	...
May	"	...	...	...	...	...	6	10	4	...	...	...	...	...
June	"	...	...	...	...	4	7	4	3	...	...	...	...	...
July	"	...	...	...	...	5	7	9	2	...	...	...	...	...
August	"	...	...	...	...	1	13	8	1	...	...	...	...	...
September	"	...	...	...	...	1	6	11	5	...	...	...	...	...
October	"	...	...	...	...	1	5	10	6	1	...	...	...	...
November	"	...	...	...	...	...	2	9	6	3	1	...	...	...
December	"	...	...	...	...	...	1	1	1	10	8	...	...	...
January	"	...	...	...	...	...	...	1	4	11	5	...	...	...
February	"	...	...	...	...	...	...	1	1	3	2	1	...	...
April	18 W.L.	...	...	...	...	...	...	...	...	...	...	...	...	...
May	"	...	...	...	...	...	...	2	4	2	1	1	...	...
June	"	...	...	...	...	...	...	2	2	...	...	...	1	
July	"	...	...	...	2	7	4	4	2	...	...	..	...	...
August	"	...	...	...	5	9	8	2	...	...	...	...	...	...
September	"	...	...	...	1	4	7	14	...	...	...	...	...	...
October	"	...	...	1	...	3	3	7	9	1	...	...	...	...
November	"	...	...	...	...	1	3	7	11	2	...	...	...	...
December	"	...	...	...	...	1	2	9	10	3	...	...	...	...
January	"	...	...	...	...	2	6	7	8	1	...	...	...	...
February	"	...	...	...	...	1	2	5	1	...	...	...	...	...
April	26 W.L.	...	...	...	...	...	...	...	4	3	...	...	...	...
May	"	...	...	...	...	...	1	3	3	...	1	...	...	...
June	"	...	...	...	1	4	5	2	1	...	...	...	...	...
July	"	...	...	...	2	9	4	3	...	...	...	...	...	...
August	"	...	...	...	2	5	2	7	1	...	...	...	1	...
September	"	...	...	1	3	5	6	3	...	...	...	...	...	...
October	"	...	...	...	...	4	3	7	5	3	...	...	...	...
November	"	...	...	...	...	...	7	4	4	...	1	...	...	...
December	"	...	...	...	...	2	5	5	2	2		1		...
January	"	...	...	...	...	4	4	4	1	3	...	...	...	...
February	"	...	...	...	...	3	1	...	...	...	...	...	...	...
April	46 W.L	...	...	...	...	...	...	...	2	3	1	1	...	...
May	"	...	...	...	...	1	...	6	9	5	...	...	...	...
June	"	...	...	...	...	2	5	9	5	1	...	...	...	...
July	"	1	...	1	3	4	6	6	...	...	...	...	..	...
August	"	...	...	...	2	6	8	6	1	..	...	...	...	...
September	"	1	...	...	1	4	3	10	5	..	1	...	...	...
October	"	...	...	...	...	1	4	10	7	4	...	...	...	...
November	"	1	...	...	...	...	4	10	6	6	1	...	...	...
December	"	...	...	...	...	...	1	3	10	10	...	...	...	...
January	"	...	...	...	...	...	...	8	11	4	2	...	...	...
February	"	...	...	...	...	...	...	3	1	3	2	...	...	...

VARIATION IN WEIGHT OF EGGS, ETC.—SECOND TEST—*continued.*

Month.	Bird No.	Ounces to 1 dozen eggs.												
		30.	29.	28.	27.	26.	25.	24.	23.	22.	21.	20.	19.	18.
April	57 B.O.	...	...	...	...	...	1	...	...	1	...	...	...	...
May	,,	...	...	...	...	6	8	3	1	2	...	...	...	...
June	,,	...	...	...	1	6	8	2	...	...	...	...	...	...
July	,,	...	...	2	4	10	3	1	...	...	...	...	...	...
August	,,	...	...	3	3	13	3	...	...	...	...	...	...	...
September	,,	...	1	1	4	9	7	1	...	...	...	...	...	...
October	,,	...	...	1	3	3	10	6	1	...	...	...	...	...
November	,,	...	...	1	2	9	7	3	1	...	...	...	...	...
December	,,	...	...	2	...	4	9	8	1	...	...	...	...	...
January	,,	...	...	1	...	4	9	10	1	...	...	...	...	...
February	,,	...	...	...	1	2	...	5	...	...	...	...	...	...
April	64 B.O.	...	...	...	...	...	1	1	...	2	...	1	1	...
May	,,	...	...	...	...	...	...	9	12	1	...	...	...	...
June	,,	...	...	...	...	...	...	...	2	1	...	...	...	...
July	,,	...	...	...	...	1	2	8	6	...	2	...	...	...
August	,,	...	...	...	...	4	9	8	...	...	...	...	...	...
September	,,	...	...	1	...	...	9	10	2	...	...	...	...	...
October	,,	...	...	...	1	1	4	9	7	1	1	...	...	...
November	,,	...	...	...	...	...	4	5	8	2	1	...	...	...
December	,,	...	...	...	...	...	...	7	10	2	3	...	...	...
January	,,	...	...	...	...	...	...	...	4	5	...	...	...	...
February	,,	...	...	...	...	...	...	1	3	1	...	2	...	...
April	79 B.O.	...	...	...	...	...	...	...	...	2	2	1	1	...
May	,,	...	...	...	...	...	2	7	2	1	...	...	...	...
June	,,	...	...	...	...	8	6	5	3	...	...	...	...	...
July	,,	1	...	...	...	2	4	2	...	1	...	...	...	...
August	,,	...	...	3	1	10	8	1	...	...	...	...	...	...
September	,,	1	...	...	...	5	11	8	1	...	...	...	...	...
October	,,	...	...	...	...	...	2	11	8	1	...	...	...	...
November	,,	...	...	...	1	...	...	6	9	5	1	...	...	...
December	,,	...	...	...	...	...	4	9	6	2	2	...	...	...
January	,,	...	...	...	...	1	3	7	7	1	1	...	...	...
February	,,	...	...	...	...	...	...	3	2	1	...	...	...	...
April	89 B.O.	...	...	...	...	...	...	6	1	2	2	1	1	1
May	,,	...	...	...	...	...	1	13	5	3	...	...	...	...
June	,,	...	...	...	...	2	11	9	...	...	...	...	...	...
July	,,	...	...	...	...	8	11	4	...	...	...	1	...	...
August	,,	...	...	...	...	11	10	3	...	...	...	...	...	...
September	,,	...	...	...	...	5	9	8	1	...	...	...	...	...
October	,,	...	...	...	...	...	2	19	3	...	...	...	...	...
November	,,	...	...	...	...	...	4	17	4	...	...	...	...	...
December	,,	...	...	...	...	1	1	14	9	...	...	...	...	...
January	,,	...	...	...	...	...	...	6	10	7	1	...	...	...
February	,,	...	...	...	...	...	1	3	4	1	...	...	...	...

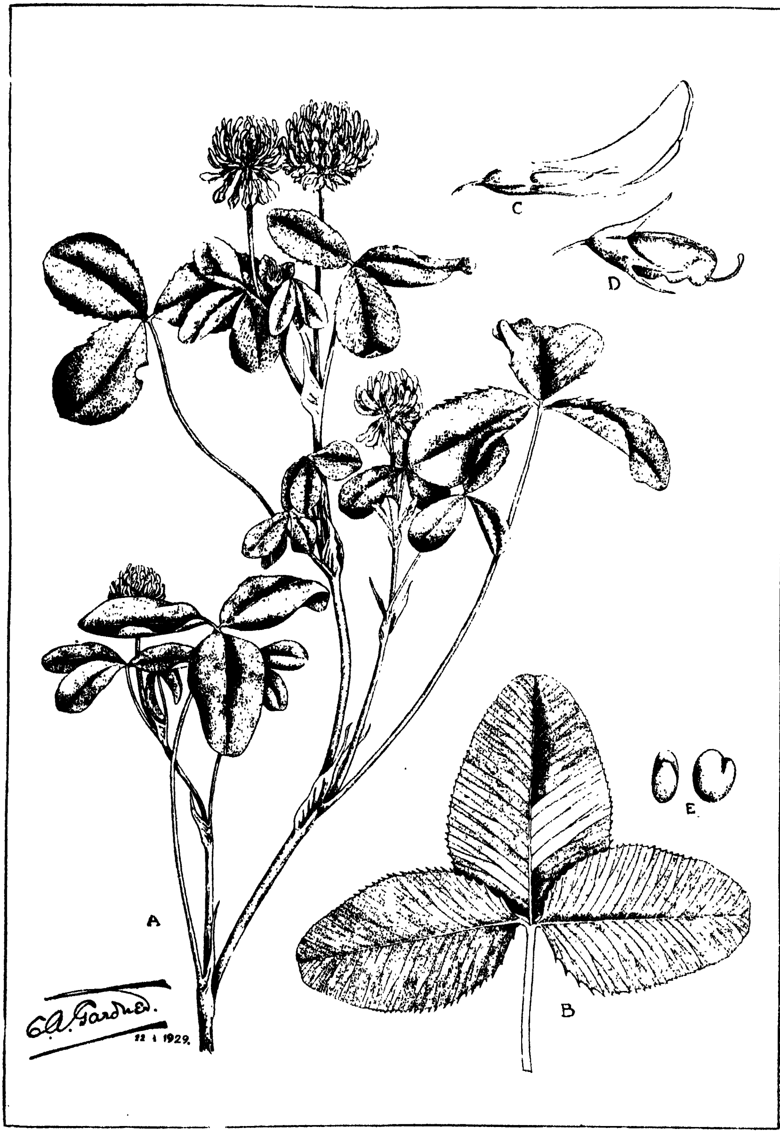
ALSIKE CLOVER.

(*Trifolium hybridum*, Linn.)

C. A. GARDNER,
Government Botanist.

This clover is indigenous to the whole of Europe excepting Britain and the extreme north, and extends to Algeria, the Caucasus and Siberia. In its wild state it inhabits damp meadows and pastures and uncultivated land, also the banks of streams. It received its common name from the village of Syke, near Upsala, in Sweden, where it is common, and has been cultivated with considerable success for well over a century. Linnaeus, in

naming the clover, regarded it as a hybrid between Red and White Clover. It is, however, specifically distinct, but in habit is intermediate between these clovers, having flowers much like those of white clover, but otherwise closely resembling Red Clover.



Alsike Clover (*Trifolium hybridum*, Linn.).

As its natural habitat indicates, Alsike Clover favours damp situations. The plant is almost insensible to cold. Its main requirement, however, is a moist soil. It cannot be expected to thrive on dry soils, or even on soils which are dry or hot during a part of the summer, except as an annual. Although it will as a rule grow where White Clover thrives, it is much more restricted on account of its moisture requirements. There are soils too dry for Alsike which are suitable for White Clover. Alsike Clover requires soil which is constantly damp. It prefers heavy soils, stiff clay or loam, especially those rich in lime, and as the rooting system is superficial an impermeable subsoil is not a disadvantage. For undrained wet clay soils, it is the most suitable of our naturalised clovers, except Strawberry Clover, which, however, does not yield the same bulk of feed.

I am indebted for the following notes on the local behaviour of Alsike Clover to Mr. P. G. Hampshire, Superintendent of Dairying:—

The clover makes excellent hay of high nutritive value. Since it is most nutritive when in flower, this is the best time for cutting.

In the lower South-West of this State, Alsike Clover can be grown successfully, either sown in a mixture or planted alone. Excellent stands have been grown in the Manjimup-Pemberton, the Denmark and Margaret River districts, thriving in rich soils with ample rain. It will not successfully withstand spring and summer weather which is hot and dry, unless the soil is moist. Under ideal conditions, compared with White Clover, it grows higher and gives heavier yields.

It is recommended for sowing in a mixture containing Rye and Cocksfoot, at the rate of one to two pounds per acre for permanent pasture in the districts, and under the conditions referred to. In such a mixture it grows tall and provides heavy growth. When sown alone eight pounds per acre is advised. The land should be well prepared, and the seeds planted in April.

Description of Plant.

Perennial, stems ascending, hollow, glabrous, not rooting at the nodes and usually branded. Leaves on long petioles, leaflets elliptical-ovate, toothed, obtuse, stipules green, finely pointed. Peduncles all axillary, longer than the leaves. Flowering heads spherical, consisting of many flowers. Pedicels much longer than the calyx reflected after flowering. Calyx glabrous, tube short, 10-ribbed, teeth linear-lanceolate, almost equal. Corolla three to four times the length of the calyx, at first white, later rose-coloured. Ovary with two to three ovules. When the fruit is developed the corolla is brown and membranous, and the standard folded longitudinally. The fruit is a flat pod longer than the calyx, and containing one to three seeds. The seeds are small and slightly flattened, yellowish-green to dark olive green, often speckled and provided with a conspicuous projection (the radicle).

The seed is obtainable locally; an average of 707,000 seeds make up one pound in weight.

Explanation of Plate.

A.—Habit.
B.—Leaf, natural size.
C.—Flower, enlarged.
D.—Pod, enlarged.
E.—Seeds, enlarged.

FIELD EXPERIMENTS WITH WHEAT AT PINGRUP.

A. S. WILD, B.Sc. (Agric.),
Agricultural Adviser.

Two experiments with wheat were conducted on the property of Messrs. Solly Bros., Pingrup. They were—

1. A variety trial.
2. A rate of superphosphate experiment.

The land on which the experiments were conducted was typical lake country. Originally carrying Blackbutt and Boree timber, the soil was a medium loam and typical of much of the forest country of the district.

During the month of July, 1927, the land had been ploughed with a mouldboard plough to a depth of four inches. At the end of September it was skim ploughed about two inches deep. Immediately prior to seeding, the land was cultivated with a springtyne implement and harrowed.

The monthly rainfalls as officially recorded at Pingrup during 1928 are shown hereunder:—

—	Jan.	Feb.	Mar.	Apl.	Useful Rains.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Pingrup...	105	...	9	150	223	119	373	186	139	59	1,099	9	38	1,410

The early part of May was unusually dry, but towards the end of that month heavy rains were experienced. Unfortunately, the serviceable rains terminated abruptly about the middle of September, October being particularly dry.

VARIETY TRIAL WITH WHEAT.

The object of this experiment is to compare the relative yields from four different varieties. Thus the two early-maturing varieties, "Gluyas Early" and "Merredin," are compared, one against the other, as well as against two later maturing varieties, "Nabawa" and "Yandilla King." The "Nabawa" (mid-season maturing) and the "Yandilla King" (late maturing) are also, in their turn, compared with each other. All plots, each half an acre in area, were planted in duplicate at the rate of 45 lbs. of graded seed per acre, with an application of 22 per cent. superphosphate at the rate of 112 lbs. per acre.

The later maturing varieties were planted on the 5th and the early maturing varieties on the 15th of May.

All varieties made good growth during the winter and early spring months, the "Nabawa" and "Yandilla King" stooling remarkably well. However, the advantage gained by these two varieties appeared to be lost when, with the rains terminating in September, much growth still remained to be completed, and the appearance of tipped heads, particularly in the "Yandilla King," was very disquieting. Well-prepared fallow and the ability of both "Nabawa" and "Yandilla King" to finish well in spite of seasonal setbacks saved the situation.

The results obtained are set out in the table hereunder:—

EXPERIMENTS AT PINGRUP—WHEAT VARIETY TRIAL.

GRAIN YIELDS.

Rate of seed—45lbs. per acre. Rate of super—112lbs. per acre. Late varieties planted 5th May. Early varieties planted 15th May.

—	Computed Yield per Acre.		Average Yield per Acre.
	Section 1.	Section 2.	
	bus. lbs.	bus. lbs.	bus. lbs.
Yandilla King	32 58	33 28	33 13
Nabawa	32 29	30 26	31 27
Gluyas Early	24 19	22 11	23 15
Merredin	20 31	20 49	20 40

When it is known that a considerable portion of the yield of the standard early variety "Gluyas Early" was lost through lodging, the above results bear out the opinion that "Yandilla King," "Nabawa" and "Gluyas Early" are suitable varieties, able to withstand periods of scanty rainfalls.

The yields from all varieties are satisfactory. In seasons of normally consistent rainfall the variety "Merredin" would probably compare more favourably with the others. Although the results are for one year only, the fact that both "Yandilla King" and "Nabawa" have done so well, under adverse conditions, establishes the suitability of both these varieties for the Pingrup district.

RATE OF SUPERPHOSPHATE EXPERIMENT.

This experiment was conducted on land of a somewhat lighter nature than that on which the variety trial was planted. The standard late variety, "Yandilla King," was planted on the 5th May, at the rate of 45 lbs. per acre. Respective plots, each half an acre in area and planted in duplicate, were treated with applications of 75, 150 and 225 lbs. of 22 per cent. superphosphate per acre.

The results obtained are as hereunder:—

EXPERIMENTS AT PINGRUP—RATE OF SUPERPHOSPHATE EXPERIMENT.

GRAIN YIELDS.

Variety—Yandilla King. Rate of seed—45lbs. per acre. Planted 5th May.

Rate of Superphosphate per Acre.	Computed Yield per Acre.		Average Yield per Acre.
	Section 1.	Section 2.	
	bus. lbs.	bus. lbs.	bus. lbs.
150 lbs.	25 41	29 38	27 44
75 lbs.	22 37	29 5	25 51
225 lbs.	28 0	*	28 0

*Results not taken owing to interference of salt patch.

These results confirm the results of similar trials carried out at the Experiment Farms, the conclusion being that, although it is advantageous and economical to increase the application of superphosphate up to 150 lbs. per acre, no economic advantage is gained by a further increase. However, the results obtained from the plots treated with the higher rates of superphosphates do refute the erroneous idea that excessive quantities of superphosphate "burn off" the crop.

FIELD EXPERIMENTS WITH WHEAT.

SALMON GUMS EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
L. G. SENIOR, Farm Manager.

The total rain recorded during 1928 was 792 points, this being 501 points below the average for the past 10 years. 579 points of rain fell during the growing period, May to October, inclusive. The average for the same period for the past 10 years is 836 points.

The following table shows the monthly rainfall for 1928, together with the average as officially recorded at Salmon Gums, one mile distant from the farm:—

Year.	Jan.	Feb.	Mch.	Apl.	Growing Period.							Nov.	Dec.	Total for Year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1928 ...	60	6	65	72	60	50	145	140	91	93	579	...	10	792
Average 10 years ...	22	48	118	117	157	144	137	136	126	136	836	70	82	1,293

The rainfalls during the growing periods, May-October, for each of the past ten years, 1919-28, are set out hereunder, together with the corresponding annual rainfalls:—

——	1919.	1920.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.
May-October	726	955	1,203	1,030	845	832	750	725	744	579
January-December	1,584	1,298	1,546	1,427	1,413	1,181	1,433	1,263	1,165	792

It will be noticed that whilst the rainfall during the month of July and August for the year under review was slightly above the average, the other months of the growing period were considerably below it, and the total, viz., 579 points, for the whole period, is the lowest officially recorded.

Sufficient rain fell during May to germinate the seed, and in June, although the crops were not showing signs of distress, anxiety was felt concerning the prospects of the season. However, normal rains were experienced during the next two months, at the end of which time the prospects were most promising.

Unfortunately the conditions did not continue, as both the September and October rainfalls were considerably below normal. Not only was it below the average and the individual registrations light, but heavy drying winds were experienced in addition, which served to reduce the usefulness of the already sub-normal registrations.

Despite these adverse conditions during the critical period, the wheat crops on the farm did not appear to be affected to any extent, but throughout the growing period maintained a healthy appearance.

The soil on which the crops were grown was representative of the different types in the district, viz., light mallee, black mallee, silver bark, teatree and gimlet mallee.

The land was cleared of timber by rolling in October, 1926, and was burnt in February, 1927.

TIME OF SEEDING EXPERIMENT.

The land on which this experiment was conducted was cleared in 1926, and ploughed with a ten-disc cultivator plough in July, 1927. It was harrowed in October, cultivated with a springtyne cultivator in January, and again prior to seeding.

The results obtained are given below:—

SALMON GUMS EXPERIMENT FARM.

Time of Seeding Experiment.

Variety—"Gluyas Early." Seed per acre—45lbs. Superphosphate per acre—90lbs. (22 per cent.)

Time of Seeding.	Computed Yield per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
June	12	32	13	12	13	52	13	52	15	12	13	44	80
May	16	32	17	4	17	12	17	4	17	20	17	4	100
July	10	8	10	32	11	36	12	8	11	28	11	12	66

Variety—"Nabawa." Seed—45lbs. per Acre. Superphosphate—(22%) 90lbs. per acre.

Time of Seeding.	Computed Yields per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
April	15	20	15	52	17	44	16	16	15	44	16	8	125
May	12	48	11	4	13	12	13	52	13	28	12	56	100
June	7	28	6	48	6	56	6	48	8	8	7	12	55

The above results being for one year only, no definite conclusions can be arrived at, but it is quite obvious from these results that the time of planting the seed of the different varieties is a most important factor, the importance of which is not generally realised by many of the settlers in the district where this farm is located.

RATE OF SEEDING EXPERIMENT.

The object of this experiment is to ascertain the most economical rate at which to sow the seed wheat.

For the purpose of the experiment two varieties of wheat having different dates of maturity were used. Yandilla King represented the late and free stooling varieties, and S.H.J. the early and sparse stooling varieties.

The land for these trials was prepared by being ploughed in July with a ten-disc cultivating plough, and harrowed in October. It was cultivated with a springtyne cultivator in January, and again prior to seeding. A good seed bed was obtained.

The results obtained are set out below:—

SALMON GUMS EXPERIMENT FARM.

Rate of Seeding Experiment.

Variety—"Yandilla King." Planted—24th April, 1928. Superphosphate—90lbs. per acre.

Rate of Seed per acre.	Computed Yields per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
30lbs.	19	36	17	12	14	56	16	32	13	36	16	24	104
45lbs.	17	4	16	56	15	52	14	40	14	8	15	44	100
60lbs.	17	20	16	40	15	52	15	20	16	48	16	24	104

Variety—"S.H.J." Planted—18th May, 1928. Superphosphate—(22%) 90lbs. per acre.

Rate of Seed per acre.	Computed Yields per Acre.										Average Yield, 1928.		Percentage Yield 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
30lbs.	13	12	14	16	15	12	12	16	11	36	13	20	100
45lbs.	16	56	14	16	13	52	13	20	8	24	13	20	100
60lbs.	14	32	14	16	12	56	13	20	12	24	13	28	101

These results indicate that it is no advantage to plant heavy rates of seed with either types of wheat.

TIME OF APPLICATION OF SUPERPHOSPHATE.

The object of this experiment, which was commenced this season, is to determine whether, when applying heavy dressings of superphosphate, it would be economical to apply part or all of the fertiliser when cultivating during the later summer or early autumn months.

The land was cleared, ploughed in July, harrowed in October, cultivated in January, again in March, and again cultivated in May prior to seeding.

The times of applying the superphosphate and the results for the season are given below:—

SALMON GUMS EXPERIMENT FARM.

Time of application of Superphosphate Experiment.

Variety—"Nabawa." Planted—11th May, 1928. Seed—45lbs. per acre.

Time of Application of Superphosphate.	Computed Yield per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
150lbs. super. in March. 75lbs. at seeding	19	28	20	32	16	32	19	4	17	52	18	40	105
225lbs. super. in March. Nil at seeding	19	44	19	36	16	48	16	24	16	16	17	44	100
75lbs. super. in March. 150lbs. at seeding	21	12	20	8	18	56	18	32	19	28	19	36	110

The results for this year are in favour of those plots which received the heaviest dressings of superphosphate at seeding time. They are also in accord with the results obtained from similar experiments carried out at the other experiment farms, which indicate that the wheat yields are decreased when portion of the fertiliser is not applied at seeding time.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

The object of this experiment is to ascertain the amount of superphosphate per acre which can be applied most profitably.

The land on which the experiment was planted originally carried mainly Silver Bark and Mallee timber.

It was ploughed in July, 1927, and harrowed in October. It was cultivated with a springtyne implement in January, and again prior to seeding in May. An excellent seed bed was obtained, and a good germination resulted.

The results are tabulated as under:—

SALMON GUMS EXPERIMENT FARM.

Rate of Application of Superphosphate Experiment.

Variety—"Nabawa" Planted—12th May, 1928. Seed—45lbs. per acre.

Rate of Superphosphate per Acre.	Computed Yields per acre.										Average Yield, 1928.		Percentage Yield, 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
150lbs.	18	48	20	24	20	16	20	24	19	20	19	52	119
75lbs.	16	48	17	28	16	40	16	24	16	0	16	40	100
225lbs.	21	28	20	40	20	40	19	12	19	28	20	16	122

These results, which are for one year only, indicate that superphosphate in excess of 75 lbs. per acre may be applied profitably, but no economic advantage is gained by increasing the rate to over 150 lbs. per acre.

SEASONAL PLANTING EXPERIMENTS.

To meet the requirements of this experiment, three sections were needed, viz.:—

(a) Section I.: Planted in April, representing early planting.
(b) Section II.: Planted in May, representing midseason planting.
(c) Section III.: Planted in June, representing late planting.

Each section, planted in its respective month, was repeated five times, all plots being eventually harvested for grain.

The objects of the experiments are:—

1. To ascertain the most suitable month to plant the late, midseason and early maturing varieties of wheat.

2. To determine the most prolific of each of the above types.

The land for this experiment was ploughed 4in. deep with a disc cultivating plough in July, 1927, and left until the following October, when it was harrowed after rain. In January it was springtyne cultivated. In March it was lightly cultivated with the same implement and again prior to seeding.

The tabulated results for the three sections of the experiment are given below:—

SALMON GUMS EXPERIMENT FARM.

Seasonal Planting Experiment.

Seed—45lbs. per acre. **Planting—April.** **Superphosphate (22%)—90lbs. per acre.**

Variety.	Maturity.	Computed Yields per acre.										Average Yield, 1928.		Percentage Yield, 1928.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
Yandilla King ...	Late ...	16	0	17	4	18	40	16	16	15	36	16	40	88
Nabawa Control ...	Mid-season	19	4	18	32	20	8	18	32	18	16	18	56	100
Gallipoli	Late mid-season	18	56	19	36	20	0	18	56	20	16	19	36	104
Baroota Wonder Early	Mid-season	13	20	18	24	18	0	19	36	19	4	17	44	97
Nabawa Control ...	Mid-season	17	44	17	20	19	4	19	12	18	56	18	24	100
Gresley	Early ...	14	16	15	36	15	52	14	56	16	3	15	20	83
Canberra	Early ...	16	8	15	36	16	40	15	52	17	12	16	16	90
Nabawa Control ...	Mid-season	18	43	17	20	17	36	18	56	17	28	18	0	100
Gluyas Early ...	Early ...	14	32	13	4	13	20	14	32	14	32	14	0	78

May Planting.

Seed—45lbs. per acre. Superphosphate—90lbs. per acre.

Variety.	Maturity.	Computed Yields per acre.										Average Yield, 1928.		Percentage Yield, 1928.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
Yandilla King ...	Late ...	13	4	12	48	12	16	16	48	15	12	14	1	88
Nabawa (Control) ...	Mid-season	13	12	14	24	14	56	18	56	18	0	15	54	100
Gallipoli	Late mid-season	12	56	14	8	14	48	16	40	16	0	14	54	94
Baroota Wonder Early	Mid-season	11	4	10	56	12	16	13	44	11	52	11	58	72
Nabawa (Control) ...	Mid-season	14	48	14	8	16	32	19	52	17	52	16	38	100
Gresley	Early ...	12	24	12	16	14	24	14	56	13	36	13	49	83
Canberra	Early ...	12	48	13	4	16	24	19	52	18	24	16	6	98
Nabawa (Control) ...	Mid-season	14	24	14	16	17	4	19	12	16	56	16	22	100
Gluyas Early ...	Early ...	14	16	13	36	15	36	16	48	17	12	15	29	94
Carrabin	Early ...	13	52	10	56	16	0	17	12	16	16	14	51	92
Nabawa (Control) ...	Mid-season	15	20	13	4	16	0	19	12	17	4	16	8	100
S.H.J.	Early ...	14	48	13	12	15	12	17	20	15	20	15	14	94
Geeralying	Very Early	13	36	12	16	14	16	15	4	13	44	15	47	99
Nabawa (Control) ...	Mid-season	16	24	14	8	15	20	18	0	16	16	16	1	100
Noongaar	Very early	19	4	15	28	16	40	15	28	16	40	16	40	104

Seed—45lbs. per acre. Superphosphate—90lbs. per acre.

Variety.	Maturity.	Computed Yields per acre.										Average Yields, 1928.		Percentage Yields, 1928.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
Noongaar	Very early	11	52	15	36	14	56	13	36	11	44	13	32	108
Nabawa (Control) ...	Mid-season	10	40	13	12	14	24	13	36	10	40	12	30	100
Geeralying	Very early	11	20	14	0	13	20	14	24	10	32	12	43	102
S.H.J.	Early ...	10	56	10	8	9	52	11	20	7	44	10	0	80
Nabawa (Control) ...	Mid-season	12	16	13	20	12	48	13	12	11	4	12	32	100
Merredin	Early ...	12	0	14	0	13	28	14	24	11	36	13	5	104
Gluyas Early ...	Early ...	12	32	13	52	14	24	14	16	11	36	13	20	107
Nabawa (Control) ...	Mid-season	10	48	13	52	12	48	13	44	10	48	12	24	100
Canberra	Early ...	12	16	14	32	13	20	14	0	12	16	13	17	107
Gresley	Early ...	8	32	10	40	9	52	12	24	11	52	10	40	84
Nabawa (Control) ...	Mid-season	11	44	14	0	12	32	14	24	11	4	12	45	100
Carrabin	Early ...	10	24	13	4	10	56	14	24	12	40	12	18	97

It will be noticed that the yields obtained from the midseason varieties planted in April showed to advantage. In the May planting this advantage

was not maintained to the same extent, the yields of the majority of the early varieties being only slightly lower, whilst the very early maturing variety, "Noongaar," was slightly better.

In the June planting, however, all except three of the early and very early maturing varieties gave better yields than did the control (midseason) variety, "Nabawa."

It will also be noticed that the yields obtained from the April and May plantings were considerably better than those obtained from the plots planted in June. However, as the above results are for one year only, it is not wise to draw definite conclusions.

WONGAN HILLS LIGHT LANDS FARM.

FIELD EXPERIMENTS WITH WHEAT AND OATS.

I. THOMAS,
Superintendent of Wheat Farms.

A. R. VENTON,
Farm Manager.

The rainfall during the past season has again been much below the average, the total amount recorded during the growing period, May-October, was 8.50 inches as against an average of 11.67 inches during the same period for sixteen years. The total for the year was 10.76 inches, the average for sixteen years being 15.21 inches. Fortunately it was fairly well distributed, and this, coupled with good seed bed and a liberal dressing of superphosphate resulted in the good yields being obtained.

——	Jan.	Feb.	Mar.	Growing Period. April	May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for Year.
1927 ...	...	7	301	34	143	221	260	89	57	50	820	5	11	11·78
1928 ...	76	...	28	79	124	109	319	169	96	35	850	5	36	10·76
Previous 15 years average	47	51	101	67	195	300	272	198	133	92	1,190	38	50	15·44

It is expected that the yields obtained would have been increased had not the October rains (35 pts.) been so much below the average (92 pts.). This appeared to affect the oats rather more than the wheat, many of the heads formed being only partly filled.

TIME OF SEEDING EXPERIMENT.

This experiment is being conducted to determine the most suitable month for planting the wheat crop in this district.

The varieties Gluyas Early and Nabawa were used, the former being planted in May, June and July, and the latter in April, May and June. The land was ploughed during 1927 to a depth of 4 inches with a Sundercut

and was cross ploughed with the same implement in September and October. During March it was lightly disced and the Nabawa Section was then springtyned prior to the April planting. The May and June plots were again cultivated with the same implement before being seeded.

The Gluyas Early section was harrowed before the May plots were planted, and the June and July plots were both cultivated with the Springtyne before being planted.

The tabulated results are given below:—

WONGAN HILLS LIGHT LAND FARM.

Time of Seeding Experiment.

Variety—Nabawa. Seed—40lbs. per acre. Superphosphate—150lbs. (22%) per acre.

Planted.	Computed Yields per acre.										Average Yield, 1928.		Percentage Yield, 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
April	22	24	21	36	21	52	20	56	20	16	21	28	100
May	22	16	22	32	20	40	20	0	21	12	21	20	100
June	9	26	10	0	7	52	9	12	7	52	8	56	42

Variety—Gluyas Early. Seed—45lbs. per acre. Superphosphate—150lbs. (22%) per acre.

Planted.	Computed Yields per acre.										Average Yield, 1928.		Percentage Yield, 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
June	11	44	11	36	11	28	11	12	10	32	11	20	49
May	23	20	23	28	23	28	22	40	22	48	23	12	100
July	10	56	10	40	10	24	10	16	...		10	32	45

Although the results are for one year only, and no definite conclusion can be arrived at, they agree with the results of similar experiments carried out at the other Experiment Farms, viz., that seeding operations should be completed by the end of May. This is the practice which is generally adopted and can be continued with confidence. The results emphasise the importance of planting the seed at the correct time.

RATE OF SEEDING EXPERIMENT—WHEAT.

As is the case at the other experiment farms, this experiment is conducted with two varieties, one representing the free stooling and the other the sparse stooling types respectively.

The land on which the trials at this farm were conducted is of the tussocky type of sand plain. It was ploughed with a disc implement (Sundercut) 4 inches deep in June and July, 1927, and cross skim-ploughed with the same implement during the following September and October. A light disc cultivation was given in March, after which it was scrub-raked. Harrows preceded the drill.

The tabulated results of both varieties for the past season and those for 1925-28 are given below:—

WONGAN HILLS LIGHT LANDS FARM.

RATE OF SEEDING EXPERIMENT—WHEAT.

Grain Yields.

Variety—Nabawa. Superphosphate—150lbs. (22%) per acre. Planted—16th May, 1928.

Rate of Seed per acre.	Computed Yields per acre.					Avearge Yields per acre, 1928.	Percentage Yields, 1928.	Average Yields per acre, 1925-28.	Average percentage Yields, 1925-28.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
60	25 36	24 16	22 48	23 4	23 12	23 47	102	18 56	101
45	24 24	23 4	23 12	23 4	23 4	23 22	100	18 48	100
90	24 16	23 36	24 32	24 8	24 24	24 11	103	18 40	99

Variety—S.H.J.

Rate of Seed per acre.	Computed Yields per acre.					Average Yields per acre, 1928.	Percentage Yields, 1928.	Average Yields per acre, 1925-28.	Average percentage Yields, 1925-28.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
60	*	25 20	25 52	26 8	*	25 47	106	16 0	103
45	24 24	25 4	23 44	24 8	23 44	24 13	100	15 36	100
90	24 48	26 16	25 20	25 36	24 8	25 14	104	16 16	104

*** Lost owing to an accident during harvesting.**

The results for this year with both varieties show that the yields are slightly increased when the heavier rates of seed are sown.

The average results, however, indicate that with a free stooling variety, no advantage is gained by planting more than 45lbs. per acre.

The average results of the sparse stooling variety confirm the results obtained this year, viz., that the yields are increased when a heavier rate than 45 lbs. is used, but there is no advantage by increasing that rate to more than 60 lbs. per acre.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

This experiment was commenced this year with the object of determining whether, when heavy dressings of super. are used, it would be profitable to apply part or all of the fertiliser when cultivating the fallowed land during late summer or early autumn, so that seeding operations can be expedited.

The land on which the experiment was conducted was tussocky sand plain. It was ploughed 4in. deep with a Sundercut in June and July the previous year, cross ploughed with the same implement in September and October, and lightly disced in March.

The soil was in good condition at seeding time. Germination was good though somewhat uneven on those plots receiving no superphosphate at the time of seeding. These latter plots continued to be backward throughout the growing period, but the difference was not so noticeable. They were, however, uneven in appearance and less dense.

The results for this season are given as under:—

WONGAN HILLS LIGHT LANDS FARM.

Time of Application of Superphosphate Experiment.

Seed—45lbs. per acre. **Planted—11th May, 1928.**

Time of application of Super.	Computed Yields per acre.										Average Yields, 1928.		Percentage Yields, 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
75lbs in March... 150lbs. at seeding	30	56	27	44	28	0	31	20	31	4	29	49	115
225lbs. in March ...	26	32	25	4	25	52	26	32	26	8	26	1	100
150lbs. in March. ... 75lbs. at seeding	27	36	28	24	32	16	26	40	24	24	27	52	107

These results are in favour of the plots which receive the heaviest dressings at planting.

They are also in accord with those obtained from a similar experiment carried out at the other Experiment Farms which indicate that the wheat yields are decreased when portion of the fertiliser is not applied at seeding time.

RATE OF SUPERPHOSPHATE EXPERIMENT.

This experiment has been conducted for the past three years for the purpose of determining the most profitable amounts of superphosphate to apply on this type of country. Three rates of application were used, viz., 75 lbs. per acre, 150 lbs. per acre, and 225 lbs. per acre.

The land was of tussocky type of sand plain on a low-lying flat. It was ploughed with a Sundercut to a depth of four inches during the winter of 1927. It was cross-disced with the same implement during October, and lightly disced in the following March. It was harrowed in front of the drill.

Germination was good, no striking difference being noted between the plots at this stage. As the season advanced, however, the difference between the control plot and the plots receiving the heavier dressings became very marked. The latter stooled better, made better growth and altogether presented a more even and attractive appearance.

The tabulated results are given below:—

WONGAN HILLS LIGHT LANDS FARM.

Rate of Superphosphate Experiment.

Variety—Nabawa. **Planted—12th May, 1928.** **Seed—45lbs. per acre.**

Rate of Superphosphate.	Computed Yield per acre.										Average Yields, 1928. Sections 1—4.		Percentage Yields, 1928. Sections 1—4.	Average Yields, 1925-28.		Percentage Yields, 1925–28.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
150	27	28	26	16	26	8	25	44	26	16	26	24	172	19	54	140
75	16	24	15	12	15	4	14	40	*		15	20	100	14	14	100
225	30	32	30	56	31	20	29	12	31	4	30	30	199	20	2	141

* Lost owing to an accident when harvesting.

The results again show that on this class of soil, dressings of superphosphate considerably in excess of 75 lbs. per acre can be applied with advantage.

MIXED FERTILISER EXPERIMENT.

The object of this experiment is to determine whether any advantage is derived by supplementing the dressing of superphosphate with a potassic manure for growing a wheat crop on light land.

Three fertilisers were used and were applied as follows:—

Plot 1. 150 lbs. Superphosphate + 56 lbs. Muriate of Potash per acre.

Plot 2. 150 lbs. Superphosphate per acre (Control).

Plot 3. 150 lbs. Superphosphate + 140 lbs. Kainite per acre.

This section of plots, each 1/8 of an acre, was repeated five times. The quantity of potash stated as K_2O is the same in 56 lbs. of the Muriate as in 140 lbs. of the Kainite.

The land was a tussocky type of sand plain which was ploughed with a Sundercut in June and July and cross ploughed with the same implement during September and October. It was disced lightly in March and harrowed prior to planting.

The potassic fertilisers were applied to the respective plots about three weeks before seeding. This course is considered advisable owing to the risk of injuring the young plants incurred by applying a fertiliser of this type at seeding time.

At no time during the growing period could any difference between the different plots be noticed.

The results obtained this year together with the average results of the past two years are as under:—

WONGAN HILLS LIGHT LANDS FARM.

Mixed Fertiliser Experiment.

Variety—Nabawa. Planted—12th May. Seed—45lbs. per acre.

Fertiliser applied per acre.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields, 1928.	Percentage 1928. Yields,	Average Yields, 1927–28.	Percentage Yields, 1927–28.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs	bus. lbs.	%	bus. lbs.	
Superphosphate 150lbs. Muriate of Potash 56lbs.	27 12	27 28	27 52	24 48	27 28	26 58	98	19 42	99
Superphosphate 150lbs.	28 0	27 44	26 32	26 56	28 16	27 30	100	19 52	100
Superphosphate 150lbs. Kainite 140lbs. ...	29 4	27 52	25 20	26 56	27 12	27 17	99	19 50	100

The results of this year and also the average results for the past two years show that the yields are not increased by applying a potassic fertiliser to this class of soil.

SEASONAL PLANTING EXPERIMENT.

To meet the requirements of this experiment, three sections were needed, viz.:—

a. Section I. planted in April representing Early Planting.
b. Section II. planted in May representing Midseason Planting.
c. Section III. planted in June representing Late Planting.

Each section planted in its respective month was repeated five times, all plots being eventually harvested for grain.

The objects of the experiment are:—

1. To ascertain the most suitable month to plant the Late, Midseason and Early maturing varieties of wheat.

2. To determine the most prolific of each of the above types:—

For the previous year's experiment, the control plots of all three sections were planted in the one month, viz., May.

This did not prove satisfactory and it was decided to plant all the plots (including the controls) of each section at the same time. With this exception the arrangement of the expeiiment was similar to that of the previous year.

The land was ploughed with a disc plough (sundercut) in June and July, 1927, and again lightly in September. The growth of suckers again necessitated a disc cultivation in March, and a springtyne cultivator preceded the drill.

The results of the three sections of this experiment are set out in the following tables:—

WONGAN HILLS LIGHT LANDS FARM.

SEASONAL PLANTING EXPERIMENT.

April Planting.

Planted—17th April, 1928. Seed—45lbs. per acre. Superphosphate—150lbs. per acre.

Variety.	Maturity.	Computed Yields per acre.										Average Yields per acre, 1928.		Percentage Yield per acre. 1928.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
Yandilla King ...	Late ...	25	52	22	16	22	8	20	56	18	48	22	0	113
Nabawa (Control)	Mid-season	20	24	20	48	18	48	19	28	18	16	19	33	100
Baroota Wonder Early	Mid-season	22	32	19	20	22	32	18	16	16	40	19	52	102
Nabawa (Control)	Mid-season	21	52	*		18	8	19	20	19	28	19	42	100
Gallipoli	Late mid-season	22	56	20	8	18	32	19	52	19	28	20	11	102
Gluyas Early ...	Early ...	18	24	15	12	16	56	15	4	16	16	16	22	84
Nabawa (Control)	Mid-season	21	52	19	44	19	36	17	28	18	56	19	31	100
Canberra	Early ...	18	48	17	4	16	0	16	24	16	16	16	54	87

* Lost owing to an accident when harvesting.

WONGAN HILLS LIGHT LANDS FARM—*continued.*

SEASONAL PLANTING EXPERIMENT—*continued.*

May Planting.

Planted—14th and 15th May, 1928. Seed—45lbs. per acre. Superphosphate—150lbs. per acre.

Variety.	Maturity.	Computed Yields per acre.										Average Yields per acre, 1928.		Percentage Yield per acre, 1928.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
Yandilla King ...	Late ...	16	48	16	48	20	8	20	24	19	20	18	42	95
Nabawa (Control)	Mid-season	17	12	18	56	*		21	12	21	4	19	36	100
Baroota Wonder Early	Mid-season	16	32	18	48	20	0	18	0	*		18	20	94
Gallipoli	Late mid-season	19	20	20	40	21	4	20	16	22	24	20	45	107
Nabawa (Control)	Mid-season	18	16	19	4	18	32	19	36	21	52	19	28	100
Gresley	Early ...	17	36	19	4	18	16	19	12	22	0	19	14	98
Canberra	Early ...	19	36	19	12	17	44	21	52	24	16	20	32	107
Nabawa (Control)	Mid-season	16	16	16	40	19	20	20	24	23	28	19	14	100
Carrabin	Early ...	15	44	19	12	19	20	16	40	21	20	18	27	96
Comeback ...	Early ...	13	52	17	44	17	44	17	4	19	44	17	14	81
Nabawa (Control)	Mid-season	17	4	22	16	21	4	21	44	24	24	21	18	100
Joffre	Mid-season	18	8	23	28	22	0	23	28	24	32	22	19	105
S.H.J.	Early ...	15	44	17	12	15	28	16	16	19	44	16	53	83
Nabawa (Control)	Mid-season	18	32	19	52	18	8	20	40	25	4	20	27	100
Noongaar	Very early	12	8	12	8	12	40	14	8	16	8	13	26	66

* Lost owing to an accident during harvesting.

June Planting.

Planted—20th June, 1928. Seed—45lbs. per acre. Superphosphate—150lbs. per acre.

Variety.	Maturity.	Computed Yields per acre.										Average Yields per acre, 1928.		Percentage Yield per acre. 1928.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus	lbs.	bus.	lbs.	
Nabawa (Control)	Mid-season	13	28	13	28	14	16	12	24	13	12	13	22	100
Carrabin	Early ...	12	0	11	28	13	28	11	28	10	24	11	46	88
Gluyas Early ...	Early ...	12	8	12	48	14	16	12	32	13	4	12	58	93
Nabawa (Control)	Mid-season	13	44	13	12	13	28	14	40	14	24	13	54	100
Canberra	Early ...	13	4	13	20	12	40	12	24	12	48	12	51	92
Joffre	Mid-season	13	36	14	24	13	4	12	24	13	36	13	25	98
Nabawa (Control)	Mid-season	13	36	14	32	14	0	13	12	13	20	13	44	100
Gresley	Early ...	11	52	12	16	10	0	9	44	9	44	10	43	78
S.H.J.	Early ...	12	48	11	52	11	12	10	16	12	24	11	42	82
Nabawa (Control)	Mid-season	14	0	14	24	14	56	14	0	13	52	14	14	100
Noongaar	Very Early	13	12	13	4	12	0	12	0	13	44	12	48	90

The results show that good yields were obtained from all varieties when planted in April, the late variety being most prominent.

In the plots planted in May good yields were also obtained except from the early variety "Noongar." In this section the Midseason and Early varieties show to advantage.

In the section planted in June, however, the yields did not equal those obtained from the earlier plantings and although there was not a great difference in the yields from most of the plots the highest yields were obtained from the control variety "Nabawa." However as these results are for one year only they cannot be taken as conclusive.

OAT VARIETY TRIAL.

This experiment was identical with the trial carried out the previous year—seven varieties being planted, including the control variety, Burts Early.

The plots were ploughed wth a disc implement (sundercut) in June and July, 1927, and were cross ploughed with the same machine in September and October of the same year. The land was scrub-raked in March, 1928.

Prior to drilling the land was springtyne cultivated and harrowed.

The tabulated results for both hay and grain are given below:—

WONGAN HILLS LIGHT LANDS FARM.

OAT VARIETY TRIAL.

Grain Yields.

Seed—40lbs. per acre. Phosphate—150lbs. per acre.

Variety.	Maturity.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yield per acre, 1928.	Percentage Yields, 1928.	Average Yield per acre, 1926–28.	Average percentage Yields, 1926–28.
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		bus. lbs.	
Mulga ...	Early ...	*	+	17 0	17 8	14 8	16 5	90	13 34	92
Burts Early (Control)	Early ...	19 0	16 8	18 0	17 32	18 24	17 37	100	15 2	100
Ruakura ...	Late mid-season	20 24	19 0	19 32	17 0	16 8	18 21	103	13 10	88
Algerian ...	Late ...	29 8	29 8	25 16	22 32	25 0	26 13	129	18 11	126
Burts Early (Control)	Early ...	19 16	19 32	20 32	21 16	21 0	20 19	100	14 22	100
Glen Innes No. 7	Midseason	28 32	28 32	23 8	23 8	24 32	25 30	126	16 37	116
Guyra ...	Midseason	22 8	29 0	19 16	*	24 32	23 34	117	16 33	111
Burts Early (Control)	Early ...	18 24	19 16	22 16	22 8	19 24	20 18	100	15 8	100
Lachlan ...	Midseason	27 16	29 0	26 24	30 32	27 8	28 8	138	16 13	107

* Owing to lodging, the yield obtained was interfered with and no comparison is made.

+ The result obtained was interfered with by an accident to the machine whilst harvesting. The yield obtained was not taken for comparison.

HAY RESULTS.

Variety.	Maturity.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Average Yield per acre, 1928.	Percentage Yields, 1928.	Average Yields per acre, 1926–28.	Average Percentage, 1926–28.
		C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.		C. Q. L.	
Mulga	Early ...	37 0 24	34 3 4	37 0 0	36 1 9	114	28 2 24	113
Burts Early (Control)	Early ...	33 3 20	32 0 16	32 2 16	32 3 17	100	25 1 10	100
Ruakura ...	Late mid-season	26 2 0	23 2 24	27 1 12	25 3 12	78	19 1 6	76
Algerian ...	Late ...	33 2 24	30 3 12	33 2 24	32 3 1	99	23 2 10	89
Burts Early (Control)	Early ...	32 3 20	32 1 12	33 2 0	32 3 20	100	26 1 13	100
Glen Innis No. 7	Midseason	35 2 24	35 0 24	35 2 24	32 0 24	98	26 2 15	101
Guyra	Midseason	33 0 8	32 2 0	33 0 16	32 3 17	106	24 1 24	99
Burts Early (Control)	Early ...	30 0 8	33 1 12	30 0 8	31 0 19	100	24 3 8	100
Lachlan ...	Midseason	34 0 24	33 1 12	29 0 8	32 0 24	103	25 1 11	102

The results for this year and the averaged results for past years show the early midseason varieties are better for hay, while the midseason and late maturing varieties are more suitable for grain.

RATE OF SEEDING EXPERIMENT—OATS.

As was the case for the similar experiment with wheat, this was planted with a free and a sparse stooling variety, and the land also was prepared identically with that for the wheat experiment.

The results of both representative types are given below, together with average results for the past three years.

WONGAN HILLS LIGHT LANDS FARM.

RATE OF SEEDING EXPERIMENT—OATS.

Grain Yields.

Variety—Burts Early. Superphosphate—150lbs. per acre. Planted—11th May, 1928.

Rate of Seed per acre.	Computed Yields per acre.										Avearge Yields per acre, 1928.		Percentage Yields, 1928.	Average Yields per acre.		Average percentage Yields, 1926 28.
	Sec. 1.		Sec.2.		Sec. 3.		Sec. 4.		Sec. 5.							
lbs.	bus.	lbs.	lbs.	bus.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		bus.	lbs.	
40	23	8	21	24	20	8	21	24	21	0	21	21	102	19	26	101
30	22	16	21	24	*		21	32	18	32	21	6	100	19	21	100
60	22	0	20	24	19	16	20	24	*		20	26	98	19	29	101

Variety—Algerian.

Rate of Seed per acre.	Computed Yields per acre.										Avearge Yields per acre, 1928.		Percentage Yields, 1928.	Average Yields per acre.		Average percentage Yields, 1926–28.
	Sec. 1.		Sec.2.		Sec. 3.		Sec. 4.		Sec. 5.							
lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		bus.	lbs.	
40	19	24	19	32	19	0	18	16	19	32	19	13	109	18	7	109
30	16	16	18	16	18	24	17	16	†		17	28	100	16	23	100
60	20	0	18	24	19	32	17	16	†		18	38	107	18	18	111

* Lost owing to an accident during harvesting. † Owing to a stoppage in the superphosphate these yields cannot be used for comparison.

These results confirm those of the two previous years, viz., that with a free stooling variety like Algerian, increased yields are obtained when the heavier rates of 40 lbs. and 60 lbs. of seed are sown. Of the two rates, however, the average results for the two years disclose that the rate of 40 lbs. per acre is the most economical.

The results with the sparse stooling variety, Burts Early, for this year and the averaged results for the three years the experiment has been carried out, show that there is practically no difference in the yields obtained from the different rates of seed.

It is surprising that with these two varieties the yields of the free stooling type were increased by the heavier rates of seed, whereas no advantage was gained when the heavy rates were sown with a sparse stooling variety. This is the reverse to what was experienced with a similar experiment carried out with wheat, and is contrary to what may have been expected. This may be due to the sparse stooling variety containing a greater number of seeds per bushel than the freer stooling one, which has larger and heavier grain.

FIELD EXPERIMENTS WITH WHEAT.

YILGARN EXPERIMENT FARM.

I. THOMAS,
Superintendent of Wheat Farms.

G. K. STEVENS,
Farm Manager.

The rainfall for the twelve months ending 31st December totalled 817 points or 224 points less than the average of 1041 points as recorded at Southern Cross for the past 35 years. During the growing period, May to October, 556 points fell, this total being 129 points below the average for the same period. Owing to the amount of timber growing around the crop, the hot winds which were experienced did not affect it to the same extent as would be expected on a more open field. The rainfall from time to time was sufficient to maintain the good healthy appearance of the crop, but a good soaking rain during September would have been beneficial and resulted in a greater yield than that actually obtained. The numerous light falls of rain during August and September appeared to benefit to a greater extent the crops growing on land which had been fallowed than those planted on unfallowed land. The yields of the latter were also affected by the rabbits during the early stages of its growth.

Below are tabulated the monthly rainfalls recorded at the farm for 1928, together with the monthly averages for the past 35 years as recorded at Southern Cross, a distance of eight miles west of the farm:—

	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for year.
					May.	June.	July.	Aug	Sept.	Oct.	Total.			
1928 ...	92	...	62	50	170	76	165	89	48	8	556	...	57	817
Average, 35 years	47	57	86	73	143	143	146	115	76	62	685	45	48	1.041

TIME OF SEEDING EXPERIMENT.

The object of this experiment is to determine the most suitable time for planting the wheat crop.

The land was ploughed during July, 1927, to a depth of 3 inches. It received springtyne cultivations in August, September, and October. It was disced in February, cultivated with the springtyne implement during April and immediately prior to seeding.

The germination was good.

The results for this year are given below:—

YILGARN EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT.

Variety—Nabawa. Seed—38lbs. per acre. Superphosphate—75lbs. (22%) per acre.

Time of Seeding.	Computed Yields per Acre. Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Average Yield, 1928.	Percentage Yield, 1928.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
April	22 24	23 36	24 24	23 36	20 56	22 56	97
May	24 48	23 12	24 48	21 12	23 44	23 36	100
June	13 12	12 40	13 36	11 44	11 12	21 32	53

Variety—Gluyas Early. Seed—43lbs. per acre. Superphosphate—75lbs. per acre.

Planted.	Computed Yield per Acre. Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Average Yields, 1928.	Percentage Yields, 1928.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
June	17 4	14 0	14 56	15 28	12 56	14 53	65
May	23 52	22 8	21 20	22 56	23 28	22 45	100
July	7 20	8 0	7 36	7 12	5 36	7 9	31

The results here are in accord with those obtained at the other Experiment Farms, namely, that seeding operations should be completed by the end of May.

RATE OF SEEDING EXPERIMENT.

This experiment is carried out with two varieties, a Midseason free stooling variety, "Nabawa," and an early sparse stooling variety, "S.H.J.."

The land, which was heavy salmon and gimlet forest country, was ploughed to a depth of three inches in July, 1927. It was worked with the springtyne cultivator during August, September and October, and was lightly disced in February. It was again springtyne cultivated in April and also immediately prior to seeding. A firm seed bed was formed and a good germination resulted.

The following tables show the results obtained this year:—

YILGARN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT.

Variety—Nabawa. Planted—11th May, 1928. Superphosphate—75lbs. (22%) per acre.

Rate of Seeding per Acre.	Computed Yields per Acre. Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Average Yield, 1928.	Percentage Yield, 1928.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
23 lbs.	22 48	23 4	23 12	24 16	22 24	23 12	103
45 lbs.	22 40	22 24	23 44	22 40	21 12	22 32	100
33 lbs.	21 52	20 56	23 28	22 48	21 20	22 8	98

Variety—S.H.J. Planted—15th May, 1928. Superphosphate—75lbs. (22%) per acre.

Rate of Seeding per Acre.	Computed Yields per Acre.					Average Yield, 1928.	Percentage Yield, 1928.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
23 lbs.	13 12	16 40	16 0	15 44	17 4	15 44	102
45 lbs.	15 4	15 52	14 40	15 28	16 16	15 28	100
33 lbs.	15 46	15 52	14 8	16 40	17 36	15 52	103

These results are for one year only, but they would seem to indicate so far that there is nothing to be gained by sowing heavy rates of seed.

TIME OF APPLICATION OF SUPERPHOSPHATE.

The object of this experiment is to determine whether, when heavy dressings of superphosphate are applied, it would be profitable to apply part or whole of the amount when cultivating the fallowed land during late summer or early autumn.

The land, which was heavy salmon and gimlet country, was fallowed to a depth of three inches in July, 1927, springtyne cultivated in August and again in September and October. It was disced to a depth of two inches in February and cultivated immediately prior to seeding.

The layout of the experiment and the results obtained are given below.

YILGARN EXPERIMENT FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE.

Variety—Gluyas Early. Planted—May. Rate of Seed—43lbs. per acre.

Details of Application of Superphosphate.	Computed Yields per Acre.					Average Yields, 1928.	Percentage Yield. 1928.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
75lbs. in March ... } 150lbs. at seeding time	28 40	28 0	26 40	26 56	23 44	26 48	107
225lbs. in March	25 4	23 52	24 56	25 28	25 28	24 58	100
150lbs. in March ... } 75lbs. at seeding time	25 36	24 32	27 44	25 28	26 56	26 3	104

These results, which are for one year only, show that the wheat yields are decreased when portion of the superphosphate is not applied at seeding time.

RATE OF APPLICATION OF SUPERPHOSPHATE.

This experiment was planted on heavy salmon and gimlet country. The land was ploughed to a depth of three inches in July, 1927, cultivated with a springtyne implement in August and received further cultivation in September and October. It was disced to a depth of two inches in February and cultivated with a springtyne in April and again immediately prior to seeding.

The results obtained this year are as follow:—

YILGARN EXPERIMENT FARM.

RATE OF SUPERPHOSPHATE EXPERIMENT.

Variety—Gluyas Early. Planted—May. Seed—48lbs. per acre.

Rate of Superphos- per Acre.	Computed Yield per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
150 lbs.	25	28	26	16	26	32	24	56	20	24	24	43	115
75 lbs.	23	12	22	16	23	28	20	40	18	8	21	33	100
225 lbs.	26	16	27	52	26	0	19	28	24	32	24	50	115

The above results which are for one year only indicate that applications of superphosphate in excess of 75 lbs. and up to 150lbs. per acre may be applied with profit. They also contradict the erroneous idea, held in some quarters, that heavy rates of superphosphate applied to new land cause the crops to "burn off."

SEASONAL PLANTING EXPERIMENT.

To meet the requirements of this experiment three sections were needed viz.:—

(a) Section I.—Planted in April, representing Early Planting.
(b) „ II.—Planted in May, representing Midseason Planting.
(c) „ III.—Planted in June representing Late Planting.

Each section, planted in its respective month, was repeated five times, all plots being eventually harvested for grain.

The objects of the experiment are:—

1. To ascertain the most suitable month to plant the Late, Midseason and Early maturing varieties of wheat.

2. To determine the most prolific of each of the above types.

The plots for this experiment were ploughed with a disc implement (sundercut) 3-4 inches deep.

The land was then springtyne cultivated in August, September and October. These workings were followed by a disc cultivation in February and another springtyne cultivation in April. This machine also preceded the drill.

The following tables show the results of the three sections of the experiment:—

YILGARN EXPERIMENT FARM:

SEASONAL PLANTING EXPERIMENT, 1928.

APRIL PLANTING.

Seed—45lbs. per acre. Planted—April 15th, 1928. Superphosphate—75lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
		Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Gresley	Early ...	20	0	17	52	21	20	18	32	17	52	19	7	80
Nabawa	Midseason	26	0	21	4	24	48	24	48	22	8	23	46	100
Canborra	Early ...	23	28	23	36	26	8	23	4	23	4	23	52	100
Gluyas Early ...	Early ...	23	4	22	24	22	48	22	8	21	52	22	27	93
Nabawa ...	Midseason	24	40	24	56	25	20	24	24	22	0	24	16	100
Merredin	Early ...	23	12	24	8	24	8	22	56	20	32	22	59	95
Geeralying ...	Very Early	22	48	23	12	21	4	22	32	20	48	22	5	90
Nabawa	Midseason	25	28	26	44	24	8	24	56	22	16	24	30	100
Noongaar	Very Early	19	52	20	48	19	20	20	24	20	56	20	16	83

MAY PLANTING.

Seed—45lbs. per acre. Planted—May 15th, 1928. Superphosphate—75lbs. per acre.

Variety.	Maturity.	Computed Yield per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yield, 1928.		Percentage Yield, 1928.
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Gresley	Early ...	15	52	18	8	16	32	15	44	15	44	16	24	74
Nabawa	Midseason	20	24	24	0	22	32	20	24	24	8	22	18	100
Canberra	Early ...	21	44	25	4	23	12	22	8	22	48	22	59	108
Gluyas Early ...	Early ...	20	40	22	32	22	56	21	20	21	12	21	44	104
Nabawa	Midseason	21	28	22	0	21	52	18	24	20	48	20	54	100
Merredin	Early ...	19	36	19	44	20	24	18	56	20	40	19	52	95
Comeback ...	Early ...	15	44	15	20	15	20	13	44	14	8	14	51	72
Nabawa	Midseason	21	28	21	28	20	32	19	28	20	40	20	48	100
Carrabin	Early ...	19	52	21	20	21	20	19	52	19	44	20	26	99
Geeralying ...	Very Early	17	20	21	44	22	24	19	20	18	8	19	47	105
Nabawa	Midseason	19	36	22	8	19	52	17	12	15	44	18	54	100
Noongaar	Very Early	20	32	21	28	19	52	19	44	15	4	19	20	102
S,H.J.	Early ...	16	40	16	0	16	48	16	16	13	20	15	48	80
Nabawa ...	Midseason	21	28	20	32	20	32	20	48	15	4	19	41	100

JUNE PLANTING.

Planted—14th June, 1928. Seed—45lbs. per acre. Superphosphate (22%)—75lbs. per acre.

Variety.	Maturity.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5. *	Average Yields, 1928.		Percentage Yields. 1928.
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus. lbs	bus.	lbs.	%
Gresley	Early ...	6	26	9	3	9	55	8	51	...	8	3	100
Nabawa (Control)	Midseason	6	47	8	41	8	41	9	44	...	8	31	100
Canberra	Early ...	9	46	12	53	14	37	12	11	...	12	21	147
Gluyas Early ...	Early ...	10	16	15	29	15	18	14	47	...	13	55	133
Nabawa (Control)	Midseason	6	37	9	44	12	0	12	34	...	10	25	100
Merredin	Early ...	8	42	13	45	14	6	11	40	...	12	0	115
Geeralying ...	Very Early	12	1	13	55	14	26	14	37	...	13	44	123
Nabawa (Control)	Midseason	7	49	10	4	13	45	12	53	...	12	6	100
Noongaar	Very Early	13	3	15	39	14	26	16	40	...	14	58	134
S.H.J.	Early ...	9	21	11	39	9	44	8	41	...	9	33	104
Nabawa (Control)	Midseason	9	3	8	10	11	7	8	41	...	9	12	100

* Owing to an accident at the time of planting the yields from this section were interfered with, and are not suitable for comparison.

Most of the Early and Very Early varieties, when planted in June, yielded better than did the control midseason variety, "Nabawa," when planted in that month.

However, as the results are for one year only, definite conclusions cannot be arrived at.

Although some of the Early varieties did not yield so well, most of them when planted in May compared favourably with the control midseason variety.

FIELD EXPERIMENTS WITH WHEAT AND OATS.

MERREDIN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
J. H. LANGFIELD, Farm Manager.

The total rainfall for the year was 873 points, and the average for the past 17 years is 1,185 points. This is the lowest annual rainfall since 1914, and the only other year on record in which the total has not exceeded 10 inches.

The rainfall during the growing period was 651 points (May to October, inclusive).

The rainfall during April, May and the early part of June was very light, and caused considerable anxiety on account of the slow and faulty germination; during July and August the rainfall was good and the crops made splendid growth, but little or no rain fell after the 2nd September, and consequently the promising growth was not maintained. Owing to the light winter rainfall there was no reserve in the soil, and early in September the crops showed the effects of the dry weather, and as only 19 points fell during October they had no opportunity of justifying their early promise.

The monthly rainfall recorded at the farm for 1928, together with the average for 17 years, is as follows:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total, May to Oct.	Nov.	Dec.	Yearly Total
1928 ...	39	...	101	58	76	107	224	154	71	19	651	...	24	873
Average, 17 yrs.	56	50	113	76	124	174	186	135	97	80	796	36	59	1,186

TIME OF SEEDING EXPERIMENT.

This experiment has been conducted for the past six years in order to determine the most suitable time for seeding the wheat crop.

The land on which the experiment was conducted this year was ploughed to a depth of four inches in July, cultivated with a springtyne implement in September, harrowed after rain during the first week in April, and lightly disc cultivated the following week, with a final cultivation with a springtyne implement prior to planting.

The results for this year, together with the average results for the past six years, are hereunder:—

MERREDIN EXPERIMENT FARM.

TIME OF PLANTING EXPERIMENT.

Variety—Gluyas Early. Seed...45lbs. per Acre. Superphosphate—120lbs. per Acre.

Planted.	Computed Yields per Acre. Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Average Yields, 1928.		Percentage Yields, 1928.	Average Yields, 1923–1928.		Percentage Yields, 1923–1928.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
June 18th ...	18	40	18	56	19	4	19	4	18	40	18	52	93	22	44	86
May 17th ...	20	0	20	48	19	52	20	40	20	24	20	20	100	26	23	100
July 16th ...	11	44	12	24	12	32	12	48	14	56	12	52	63	13	46	52

TIME OF PLANTING EXPERIMENT.

Table showing analysis of Average Yields, 1923–28.

Year.	Yields.					
	Planted May.		Planted June.		Planted July.	
	bus.	lbs.	bus.	lbs.	bus.	lbs.
1923	24	13	27	33	15	47
1924	30	56	28	0	20	8
1925	17	20	16	40	10	24
1926	23	4	18	16	11	20
1927	32	27	27	5	12	7
1928	20	20	18	52	12	52
Average, 1923–28 ...	26	23	22	44	13	46
Percentage Yields ...	100%		86%		52%	

There is only one conclusion that can be arrived at from the above results of the experiment, and that is that seeding should be completed during the month of May. This is the practice generally adopted, and can be continued with every confidence.

RATE OF SEEDING EXPERIMENT.

As in previous years this experiment was carried out with the two varieties, "Nabawa" and "Florence," representing the free and sparse stooling varieties respectively.

The land was ploughed in June, 1927, and springtyne cultivated in September. It was harrowed after rain at the end of March, and disc cultivated in April. It was then cultivated with a springtyne implement prior to seeding.

The results obtained this year, together with the average results of past years, are as under:—

MERREDIN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT.

Variety—Nabawa. Planted—1st May, 1928. Superphosphate—120lbs. per Acre.

Rate of Seed per Acre.	Computed Yields per Acre.										Average Yield, 1928.		Percentage Yield, 1928.	Average Percentage Yield, 1915–28.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.					
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	%
30 lbs.	9	20	9	36	9	44	10	0	11	20	10	0	97	95
45 lbs....	9	36	10	40	8	56	10	24	12	0	10	16	100	100
60 lbs.	9	52	10	24	10	16	10	48	11	44	10	32	103	100

From the results obtained at this farm in this and previous years, it is apparent that it is unnecessary to sow either the sparse or free stooling varieties at a higher rate than 45 lbs. of graded seed per acre.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

This experiment was commenced during the past season with the object of determining whether, when heavy dressings of superphosphate are used, it would be economical to apply part or all of the fertiliser when cultivating the fallowed land during the late summer or early autumn to enable seeding operations to be expedited.

To suit the requirements three plots were required. Each section was repeated five times.

The land for this experiment was ploughed in June, 1927, to a depth of four inches, and cultivated with a springtyne implement in September. When the superphosphate was applied on 21st March no rain of any consequence had fallen since the 15th of December. The soil which was very dry was lightly cultivated, first with a springtyne implement. The plots were harrowed after 84 points of rain at the end of March.

The results obtained are shown hereunder:—

MERREDIN EXPERIMENT FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

Variety—Gluyas Early. Planted May 14th, 1928. Seed—45lbs. per Acre.

Time of Application.	Computed Yield per Acre. Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Average Yields, 1928.		Percentage Yields, 1928.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
75lbs. in March; 150lbs. at seeding	20	48	20	32	20	16	20	8	20	40	20	28	104
225lbs. in March	21	20	20	16	18	56	19	12	18	32	19	39	100
150lbs. in March; 75lbs. at seeding	22	24	20	48	20	56	20	24	19	28	20	48	106

As the results of this experiment are for one year only, no definite conclusions can as yet be drawn, but the indications are that the yields are decreased when portion of the fertiliser is not applied at seeding time.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

The land for this experiment was fallowed during the winter of 1927, and springtyne cultivated in September. It was harrowed after rain at the end of March, disc cultivated in April, and again springtyned before planting.

The results obtained this year, together with the average results for the past six years, are tabulated below:—

MERREDIN EXPERIMENT FARM.

Rate of Superphosphate Experiment.

Variety—Gluyas Early. Planted 12th May, 1928. Seed—45lbs. per acre.

Rate of Superphosphate.	Computed Yield per acre. Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.		Average Yields, 1928.		Percentage Yields. 1928.	Average Yields, 1923–28.		Percentage Yields. 1923–28.
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
150	19	44	20	40	Plot lost		20	40	19	44	20	12	110	24	5	110
75	19	4	17	20	18	0	19	12	18	24	18	24	100	21	56	100
225	21	36	19	28	21	20	20	24	20	56	20	44	113	25	25	116

The results again show that the wheat yields are increased when dressings of superphosphate greater than 75 lbs. per acre are applied.

NITROGEN EXPERIMENT.

This experiment is conducted for the purpose of ascertaining whether—

(1) A small quantity of nitrogenous fertiliser, 25 lbs. of sulphate of ammonia, applied at planting time has a beneficial effect upon the yields of wheat crops; and

(2) Whether the same quantity of nitrogenous fertiliser will lessen the need for fallowing.

For the purpose of this trial five plots were required, of which three were fallowed in June, 1927, and the other two were left unfallowed. The fallowed plots were ploughed with a heavy disc implement four inches deep, and were cultivated in September. They were harrowed in March after rain.

The unfallowed plots were ploughed early in April, after 24 points of rain which fell at the end of March.

All plots were disc cultivated before planting.

The tables below give the results for the year, together with the averages from the commencement of the experiment (four years). A percentage comparison between the fallowed and unfallowed plots is also given.

MERREDIN EXPERIMENT FARM.

NITROGEN EXPERIMENT.

Variety—Nabawa. Planted 12th May, 1928. Superphosphate—120lbs. per Acre.

Treatment.	Fallow. Computed Yields per Acre. Section 1.	Section 2.	Section 3.	Average, 1928.	Percentage Yields, 1928.	Percentage Yields, 1925–28.	Non-Fallow. Computed Yields per Acre. Section 1.	Section 2.	Average Yields, 1928.	Percentage Yields, 1928.	Percentage Yields, 1925–28.
	bus. lbs.	bus. lbs.	bus. lbs.	b. lbs.	%	%	bus. lbs.	bus. lbs.	b. lbs.	%	%
120lbs. Super ...	18 56	15 44	17 12	17 20	100	100	9 4	6 56	8 0	100	100
120lbs. Super plus 25lbs. Sulphate of Ammonia	18 56	15 44	19 20	18 0	104	99	8 8	6 24	6 40	83	92

COMPARISON OF FALLOWED AND UNFALLOWED LAND.

	120lbs. Super per Acre. Percentage, 1928.	Percentage, 1925-28.	120lbs. Super plus 25lbs. Sulphate of Ammonia. Percentage, 1928.	Percentage, 1925-28.
	%	%	%	%
Fallow	100	100	100	100
Non-Fallow	46	61	37	58

The results again indicate that on heavy forest land the application of a small amount of nitrogenous fertiliser at seeding time does not increase the yields. Neither does the small dressing lessen the need for fallowing, as is shown very clearly in the second table.

SEASONAL PLANTING EXPERIMENT.

To meet the requirements of this experiment three sections were needed, viz.:—

(a) Section I.—Planted in April, representing early planting.

(b) Section II.: Planted in May, representing midseason planting.

(c) Section III.: Planted in June, representing late planting.

Each section, planted in its respective month, was repeated five times, all plots being eventually harvested for grain.

The objects of the experiment are:—

1. To ascertain the most suitable month to plant the Late, Midseason and Early maturing varieties of wheat.

2. To determine the most prolific of each of the above types.

For the previous year's experiment the control plots of all three sections were planted in the one month, viz., May.

This did not prove satisfactory, and it was decided to plant all the plots including the contro's of each section at the same time.

With this exception the arrangement of the experiment was similar to that of the previous year.

The land on which this experiment was conducted was ploughed with a heavy disc implement during the previous June to a depth of four inches. It was cultivated during September, and harrowed after 84 points of rain in March. During the second week of April it was cultivated with the tandem disc.

The May and June plots were both springtyne cultivated in May, and the June plot was harrowed before planting.

Germination was uneven and early growth slow. The crops were affected somewhat by the dry period in September.

Tabulated results are as under:—

MERREDIN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT.

APRIL PLANTING.

Planted 19th April, 1928. Seed—43lbs. per Acre. Superphosphate—120lbs. per Acre.

Varieties.	Maturity.	Computed Yields per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
		Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Yandilla King ...	Late	19	36	17	4	18	16	14	0	16	8	17	4	90
Nabawa (Control)	Midseason ...	19	52	18	40	18	56	18	32	18	56	18	56	100
Joffre	Late-Midseason	20	56	18	16	19	20	18	0	19	28	19	12	101
Gallipoli ...	Late-Midseason	19	28	17	36	18	8	19	4	20	32	18	56	100
Nabawa (Control)	Midseason ...	18	48	19	4	18	8	19	4	19	28	18	56	100
Gluyas Early ...	Early. ...	16	56	16	48	15	36	18	24	16	16	16	48	89
Canberra ...	Early ...	19	44	19	52	17	4	19	52	18	0	18	56	97
Nabawa (Control)	Midseason ...	21	4	19	12	16	40	19	28	20	16	19	20	100
Carrabin ...	Early ...	17	36	16	0	13	28	15	20	17	4	15	52	82

MAY PLANTING.

Planted 17th May, 1928. Seed—43lbs. per Acre. Superphosphate—120lbs. per Acre.

Varieties.	Maturity.	Computed Yields per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
		Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Yandilla King	Late ...	15	12	7	44	6	8	6	16	8	24	8	48	59
Nabawa (Control)	Midseason ...	20	0	15	20	12	8	12	16	14	40	14	56	100
Joffre	Late-Midseason	20	40	16	0	14	48	12	56	14	40	15	52	106
Gallipoli ...	Late-Midseason	19	12	8	48	11	20	10	32	12	8	12	56	81
Nabawa (Control)	Midseason ...	21	44	14	8	15	4	14	0	14	48	16	0	100
Comeback ...	Early ...	15	12	10	8	11	4	11	20	10	24	11	36	72
Carrabin ...	Early ...	17	44	13	28	13	4	13	12	12	0	13	52	90
Nabawa (Control)	Midseason ...	19	28	13	52	14	40	15	4	14	32	15	28	100
Gresley ...	Early ...	18	16	12	40	13	44	14	16	12	56	14	24	93
Merredin ...	Early ...	21	20	15	44	16	40	16	40	16	40	17	28	115
Nabawa (Control)	Midseason ...	18	48	13	4	13	44	15	20	14	48	15	12	100
Canberra ...	Early ...	22	32	17	52	16	8	19	12	16	40	18	32	122
Gluyas Early ...	Early ...	19	36	16	0	15	4	17	12	15	20	16	40	110
Nabawa ...	Midseason ...	19	20	14	24	12	32	15	36	14	16	15	12	100
S.H.J. ...	Early ...	17	52	12	32	11	36	14	0	11	12	13	28	88
Geeralying ...	Very Early ...	20	40	14	56	13	44	17	12	13	44	16	0	109
Nabawa (Control)	Midseason ...	20	0	14	0	11	28	15	28	12	8	14	40	106
Noongaar ...	Very Early ...	18	8	15	28	11	36	15	20	12	32	14	40	100

JUNE PLANTING.

Planted—15th June, 1928. Seed—43lbs. per Acre. Super—120lbs. per Acre.

Varieties.	Maturity.	Computed Yields per Acre.										Average Yield, 1928.		Percentage Yield, 1928.
		Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Carrabin ...	Early ...	12	40	...		10	32	12	24	12	0	11	52	91
Nabawa (Control)	Midseason ...	13	20	14	24	11	12	13	28	12	56	13	4	100
Gluyas Early ...	Early ...	16	8	15	44	13	28	15	36	15	20	15	12	116
Canberra ...	Early ...	16	0	15	36	14	56	14	24	15	20	15	12	115
Nabawa (Control)	Midseason ...	14	48	13	44	12	40	11	52	12	48	13	12	100
Merredin ...	Early ...	15	20	12	40	13	36	13	44	14	0	13	52	105
Gresley ...	Early ...	11	12	9	52	9	52	10	48	10	32	10	24	79
Nabawa (Control)	Midseason ...	14	40	11	52	12	8	13	36	13	20	13	4	100
S.H.J. ...	Early ...	13	28	10	8	11	44	10	24	11	12	11	20	87
Noongaar ...	Very Early ...	15	36	12	32	15	28	14	16	14	56	14	32	113
Nabawa (Control)	Midseason ...	13	52	11	52	13	4	12	32	12	48	12	48	100
Gerralying ...	Very Early ...	13	44	12	8	13	52	13	52	13	28	13	28	105

It will be noticed that the yields obtained from most of the varieties planted in both May and June show to advantage. As the above results are for one year only, it would be unwise to attempt the deduction of definite conclusions, particularly with an experiment of this nature where more than one important factor is liable to influence the yields.

Until the experiment has been conducted sufficiently long enough for definite conclusions to be arrived at, it is well to be guided by past experience, which has shown that in normal years it is inadvisable to plant early varieties in April.

OAT VARIETY TRIAL.

This experiment has been conducted for the past six years. Four varieties were used with "Burts Early" as the control.

The land, which was typical Gimlet and Salmon Gum country, was ploughed in June, 1927, to a depth of four inches, cultivated with a spring-

tyne cultivator in September, and harrowed after 84 points of rain on the 29th March. It was disc cultivated early in April, springtyned again before planting, and harrowed after drilling.

The results obtained this year, together with the percentage averages for previous years, are given below:—

MERREDIN EXPERIMENT FARM.

OAT VARIETY TRIAL.

GRAIN YIELDS.

Seed—40lbs. per Acre. Superphosphate (22%)—120lbs. per Acre.

Variety.	Computed Yields per Acre.										Average Yields, 1928.		Percentage Yields, 1928.	Average Yields, 1923-28.		Percentage Yields, 1923-28.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.							
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
Burt's Early ...	32	24	29	16	30	8	28	24	24	24	29	3	100	27	14	100
Glen Innes No. 7	30	8	28	32	29	8	27	0	29	24	28	38	100	27	25	101
Algerian ...	11	16	8	8	11	8	10	0	13	8	10	32	37	25	25	94
Guyra ...	30	8	27	32	28	24	28	32	26	0	28	11	96	29	28	105
Mulga ...	34	0	31	32	32	16	33	32	29	16	32	11	110	34	8	121
Burt's Early ...	30	8	28	32	31	16	33	24	22	24	29	13	100	28	9	100

The results this season further confirm the conclusion already drawn that, for districts with a rainfall similar to that of Merredin, the Early and Midseason varieties are the most suitable for both hay and grain.

FIELD EXPERIMENTS WITH WHEAT.

CHAPMAN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
P. JEFFREY, Farm Manager.

The land on which the experiments were conducted originally carried Jam with a little York Gum timber, and had been cleared some years previously.

The following table shows the monthly rainfall recorded at the farm during the year, together with the averages for the past 23 years:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total.	Nov.	Dec.	Total for year.
					May.	June.	July.	Aug.	Sept.	Oct.				
1928 ...	56	...	40	35	315	262	603	243	139	85	1,647	4	7	1,789
Average, 23 years	27	50	69	43	227	432	394	264	172	97	1,586	26	29	1.830

These records show the total rainfall for the year to be 41 points below, and that for the growing period to be 61 points above, the average.

Light rains fell in March and April, and were followed by a dry spell from 29th April to the 20th of May, which caused some considerable anxiety. During the last ten days of May, however, over 300 points were registered. This was excessive, and caused the land to become waterlogged, which was not to the advantage of the crops already sown, and in addition cultural operations were delayed for some considerable time.

All the experiments were planted on fallowed land. This was ploughed during the winter months of 1927, after which it was worked with either a springtyne or a disc cultivator to destroy weeds and assist in the formation of a soil mulch. It was again cultivated after the rains in March and April, and prior to seeding time few weeds were in evidence. Shortly after the completion of seeding operations, however, there was a vigorous weed growth in nearly all the paddocks.

This was due to the early rains not being sufficiently heavy to germinate all the weed seeds, and so allow of their destruction by cultivation prior to seeding.

TIME OF SEEDING EXPERIMENT.

This experiment was commenced in 1923 and has been planted each year since, but, owing to the plots being destroyed by fire in 1924 and other factors interfering, the results were not obtained in 1925 and 1926.

Until this year the experiment has been confined to the early variety, "Gluyas Early," planted in May, June and July. This year the midseason variety, "Nabawa," was included, planted in April, May and June.

The land was ploughed with a four-furrow mouldboard plough in July, 1927, and was springtyne cultivated in October, 1927, and again in March, 1928. The whole was again springtyne cultivated prior to seeding.

The May and June sections in the "Nabawa" portion of the experiment, and the June and July sections in the "Gluyas Early" portion, all received additional cultivations immediately prior to seeding.

The April and May plantings were sown on a dry seed bed, but the later sowings were in moist ground.

The following tables show the results obtained:—

CHAPMAN EXPERIMENT FARM.

TIME OF SEEDING EXPERIMENT.

Variety—"Gluyas Early." Seed—45lbs. per acre. Superphosphate (22%)—112lbs. per acre.

Planted.	Computed Yield per Acre.					Average yield per Acre, 1928.	Percentage Yield, 1928.	Average Yield, 1923 and 1927-28.	Average Percentage Yield, 1923 & 1927-28.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
May	15 20	15 20	15 4	15 36	15 44	15 28	100	18 8	100
June	12 16	12 48	13 4	12 48	12 56	12 48	83	14 48	82
July	8 16	6 40	9 20	6 24	5 52	7 20	48	10 24	57

Variety—"Nabawa." Seed—45lbs. per acre. Superphosphate—(22%) 112lbs. per acre.

Planted.	Computed Yield per Acre.					Average Yield per acre, 1928.	Percentage Yield, 1928.
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%
April	11 28	13 28	13 28	12 24	13 4	12 48	99
May	12 40	12 40	13 20	13 4	12 56	12 56	100
June	11 44	11 44	9 28	10 32	9 44	10 40	83

From these results it can be definitely concluded that when an early variety is planted the yields are considerably reduced when the planting is delayed until June. They also indicate that it is an advantage to commence seeding operations in April so that they may be completed by the end of May.

RATE OF SEEDING EXPERIMENT.

As in previous years this experiment was carried out with two varieties, viz., "Yandilla King," a late free-stooling variety, and "S.H.J.," an early, sparse-stooling variety.

The land on which this experiment was planted was fallowed in September, 1927, and cultivated with a springtyne implement in October, 1927. It was cultivated in April, 1928, and again in May prior to seeding.

The seed was sown in a dry seed bed, and did not germinate until the fourth week in May. There was considerable weed growth on all the plots.

The results obtained this year, together with the averages for the past five years are as follow:—

CHAPMAN EXPERIMENT FARM.

RATE OF SEEDING EXPERIMENT.

GRAIN YIELDS.

Variety—"Yandilla King." Planted 30th April, 1928. Superphosphate (22%)—150lbs. per acre.

Rate of seed per acre.	Computed Yields per Acre.										Average Yields per Acre, 1928.		Percentage Yield, 1928.	Average Yield per Acre, 1923-28.		Average Percentage Yield, 1923-28.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.							
lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
60	16	0	17	12	18	32	17	44	15	20	16	56	109	18	32	99
45	15	4	15	4	17	20	14	24	16	0	15	36	100	18	48	100
90	17	20	16	48	18	40	15	28	16	24	16	56	109	19	12	102

HAY YIELDS.

Rate of Seed per Acre.	Computed Yields per Acre.									Average Yield per Acre, 1928.			Percentage Yields, 1928.	Average Yield per Acre, 1923-28.			Average Percentage. Yields. 1923-28.
	Section 1.			Section 2.			Section 3.										
lbs.	cwts.	qrs.	lb.	cwt.	qr.	lb.	cwt.	qr.	lb.	cwt.	qr.	lb.	%	cwt.	qr.	lb.	%
60	28	1	12	30	1	12	27	2	24	28	3	4	104	25	0	24	95
45	27	1	20	26	2	8	28	2	24	27	2	8	100	26	2	16	100
90	33	1	20	29	1	4	30	2	0	31	0	8	113	27	0	8	102 .

GRAIN YIELDS.

Variety—"S.H.J." Planted 7th June, 1928. Superphosphate (22%)—150lbs. per acre.

Rate of Seed per Acre.	Computed Yield per Acre.										Average Yield per Acre, 1928.		Percentage Yield, 1928.	Average Yield per Acre, 1923-28.		Average Percentage Yields. 1923-28.
	Section 1.		Section 2.		Section 3.		Section 4.		Section 5.							
lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	bus.	lbs.	%
60	22	48	22	24	24	24	23	44	21	20	22	56	106	17	36	107
5	22	8	23	4	22	48	21	4	19	20	21	44	100	16	32	100
90	23	44	24	56	25	12	23	52	22	16	23	44	109	18	24	111

HAY YIELDS.

Rate of Seed per Acre.	Computed Yield per Acre. Section 1.	Section 2.	Section 3.	Average Yield per Acre, 1928.	Percentage Yield, 1928.	Average Yield per Acre, 1923–28.	Average Percentage Yields, 1923–28.
lbs.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	%	cwt. qr. lb.	%
60	30 3 20	32 0 24	31 1 28	31 2 0	98	28 0 8	104
45	31 3 12	31 0 16	32 2 8	32 0 24	100	27 0 0	100
90	34 3 20	34 3 4	34 0 16	34 2 16	108	28 0 8	104

These results confirm those of previous years, which indicated that with a sparse-stooling variety the yields of both hay and grain are increased when the heavier rates of seed are sown.

The results obtained this season from the free-stooling variety show that increased yields of both hay and grain were obtained from the plots with the higher rates of seeding. The average results for the past six years, however, show that little or no difference is obtained from the different rates of seeding a free-stooling variety.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

This experiment was commenced during the past season with the object of determining whether, when heavy dressings of superphosphate are used, it would be economical to apply part or all of the fertiliser when cultivating the fallowed land during the late summer or early autumn, thus enabling seeding operations to be expedited.

To suit the requirements of this experiment three plots were used. Each section was repeated five times.

The land which was York Gum and Jam country was fallowed during September, 1927, and springtyne cultivated in October. It was springtyne cultivated prior to the application of superphosphate in March, and again before seeding.

CHAPMAN EXPERIMENT FARM.

TIME OF APPLICATION OF SUPER EXPERIMENT.

Variety—"Nabawa." Planted 16th May, 1928. Seed—45lbs. per acre.

Time of Application.	Computed Yields. Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Average Yield, 1928.	Percentage Yield, 1928.
	bus. lbs.	bus. lbs.	bus. lbs.	qus. lbs.	bus. lbs.	bus. lbs.	%
75lbs. super in March; 150lbs. super at Planting	14 56	17 36	18 0	16 24	16 24	16 40	117
225lbs. super in March	13 44	15 52	13 52	13 28	14 8	14 13	100
150lbs. super in March; 75lbs. super at Planting	15 52	17 36	16 24	15 4	15 52	16 9	113

As the results of this experiment are for one year only, no definite conclusions can as yet be drawn, but the indications are that the yields are decreased when a portion of the fertiliser is not applied at seeding time.

RATE OF SUPERPHOSPHATE EXPERIMENT.

This experiment was commenced in 1923, and has been continued each year since, except in 1926, when the results were discarded.

The land was ploughed during September, 1927, with a mouldboard plough, and was springtyne cultivated during the same month. It was springtyne cultivated in March, and again prior to seeding.

Germination was delayed owing to absence of rain, and later considerable weed growth was in evidence.

The tabulated results for this year, together with the averages since 1923, are given below:—

CHAPMAN EXPERIMENT FARM.

RATE OF SUPER EXPERIMENT.

GRAIN RESULTS.

"Variety—Nabawa." Planted 16th May, 1928. Seed—45lbs. per acre.

Rate of Superphosphate per Acre.	Computed Yield per Acre. Section 1.		Section 2.		Section 3.		Section 4.		Section 5.		Average Yield per Acre, 1928.		Percentage Yield, 1928.	Percentage Yield, 1923-28.*
lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%	%
150	15	44	17	20	15	28	16	32	17	52	16	32	110	110
75	15	36	16	16	13	20	14	56	14	48	14	56	100	100
225	19	4	18	0	18	8	18	40	19	44	18	40	125	117

* 1926 results not taken.

HAY RESULTS.

Rate of Superphosphate per Acre.	Computed Yield per Acre. Section 1.			Section 2.			Section 3.			Average Yield per Acre, 1928.			Percentage Yield, 1928.	Percentage Yield, 1923-28.*
lbs.	cwt.	qr.	lb.	cwt.	qr.	lb.	cwt.	qr.	lb.	cwt.	qr.	lb.	%	%
150	32	1	12	31	0	0	31	2	8	31	2	16	114	112
75	27	2	24	28	1	12	26	3	4	27	2	16	100	100
225	33	3	4	33	2	24	32	0	0	33	0	16	120	115

* 1926 results not taken.

As with a similar experiment at the Merredin Experiment Farm it is again demonstrated that the use of heavier dressings of superphosphate results in increased yields for both hay and grain.

NITROGEN EXPERIMENT.

The objects of this experiment are to determine—

(1) whether a small quantity of nitrogenous fertiliser, 25 lbs. per acre of sulphate of ammonia, applied at planting time has a beneficial effect upon the yields of wheat crops; and

(2) whether the same quantity of nitrogenous fertiliser will lessen the need for fallowing.

For the purpose of the trial three plots were fallowed in September, 1927, and two plots situated between these were left unfallowed. The fallowed plots were ploughed with a mouldboard plough from 4 to 4½ inches deep, cultivated with a springtyne cultivator in October, 1927, and again in April, 1928, and also prior to seeding.

The unfallowed plots were ploughed with a heavy disc plough in May, and cultivated prior to seeding.

The land upon which this experiment was conducted originally carried York Gum and Jam timber.

Sheep were run on both the fallowed and unfallowed plots in order to assist in the control of weed growth.

The tabulated results are as follow:—

CHAPMAN EXPERIMENT FARM.

NITROGEN EXPERIMENT.

Variety—"Nabawa," 45lbs. per acre. Planted 24th May, 1928. Superphosphate (22%)—112lbs. per acre.

Treatment.	Fallowed.						Unfallowed.						
	Computed Yield per Acre.			Average, 1928.	Percentage Yield.		Computed Yield per Acre.		Average, 1928.	Percentage Yield.		Percentage Comparisons.	
	Section 1.	Section 2.	Section 3.		1928.	1926-28	Section 1.	Section 2.		1928.	1926-28.	Fallowed.	Unfallowed.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%	bus. lbs.	bus. lbs.	bus. lbs.	%	%	%	%
112lbs. super	18 8	21 28	18 32	19 20	100	100	17 52	13 44	15 44	100	100	100	80
112lbs. super plus 25lbs. sulphate of ammonia	18 0	19 20	19 44	18 56	98	97	18 24	14 48	16 40	106	103	100	89

This experiment has been conducted for the past three years, and from the results obtained it is quite evident that no beneficial results are obtained when a small application of sulphate of ammonia is applied to the land which

has been fallowed. Whilst the results this year from the non-fallowed plots, and also the percentage yields for the three years the trials have been conducted, show that the yields were increased by the addition of a light application (25 lbs.) of the nitrogenous fertiliser, the increase was not sufficient to cover the extra cost of the application.

These results also establish the fact that a light application of a nitrogenous fertiliser does not remove the need for fallowing, but rather emphasises its importance as a limiting factor for the growth of the wheat crop.

SEASONAL PLANTING EXPERIMENT.

To meet the requirements of this experiment three sections were needed, viz.—

(a) Section I.: Planted in April, representing Early planting.

(b) Section II.: Planted in May, representing Midseason Planting.

(c) Section III.: Planted in June, representing Late Planting.

Each section, planted in its respective month, was repeated five times, all plots being eventually harvested for grain.

The objects of the experiment are:—

(1) To ascertain the most suitable month to plant the Late, Midseason and Early maturing varieties of wheat.

(2) To determine the most prolific of each of the above types.

For the previous years experiment the control plots of all three sections were planted in the one month, viz., May.

This did not prove satisfactory, and it was decided to plant all the plots (including the controls) of each section at the same time.

With this exception the arrangement of the experiment was similar to that of the previous year.

The land was ploughed with a mouldboard plough in July, 1927. It was springtyne cultivated in October, 1927, again in the following April after rain, and finally prior to seeding.

The tables of the results of the several sections are given below:—

CHAPMAN EXPERIMENT FARM.

SEASONAL PLANTING EXPERIMENT.

APRIL PLANTING.

Planted 18th April, 1928. Seed—45lbs. per Acre. Superphosphate (22%)—112lbs. per Acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yield.		Percentage.
		Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Yandilla King	Late	14	16	15	28	13	44	13	20	14	8	14	11	97
Nabawa (Control)	Midseason ...	15	20	14	0	14	56	14	48	14	16	14	40	100
Baroota Wonder Early	Midseason ...	15	28	13	52	14	48	13	52	14	24	14	29	99
Joffre	Late-Midseason	15	44	13	4	15	52	14	48	15	4	14	54	109
Nabawa (Control)	Midseason ...	15	12	*		13	12	13	20	13	4	13	42	100
Gluyas Early ...	Early	14	0	12	56	14	56	13	28	13	4	13	41	100
Canberra ...	Early	15	52	14	48	15	36	15	44	15	20	15	28	110
Nabawa (Control)	Midseason ...	16	0	12	0	13	4	14	8	15	20	14	6	100
Gallipoli ...	Late-Midseason	15	20	14	0	14	32	14	16	14	8	14	27	102

* As the yield of this plot has evidently been interfered with it was decided to discard the result.

CHAPMAN EXPERIMENT FARM—*continued.*

SEASONAL PLANTING EXPERIMENT—*continued.*

MAY PLANTING.

Planted 22nd May, 1928. Seed—45lbs. per Acre. Superphosphate (22%)—112lbs. per Acre.

Variety.	Maturity.	Computed Yields per Acre.										Average Yield.		Percentage.
		Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Yandilla King	Late	14	16	15	52	16	16	15	4	15	12	15	20	95
Nabawa (Control)	Midseason ...	16	16	16	56	17	4	15	4	15	44	16	13	100
Baroota Wonder Early	Midseason ...	15	28	15	36	15	36	13	20	14	24	14	53	92
Joffre	Late-Midseason	14	0	16	24	17	36	16	0	16	16	16	3	104
Nabawa (Control)	Midseason ...	14	16	15	52	17	4	14	56	15	20	15	29	100
Gallipoli ...	Late-Midseason	14	16	15	28	18	0	16	48	16	56	16	18	105
Gluyas Early ...	Early	13	12	14	24	15	44	15	28	13	44	14	30	89
Nabawa (Control)	Midseason ...	15	4	16	56	17	20	17	12	14	40	16	14	100
Canberra ...	Early	13	4	14	40	16	8	16	8	14	48	14	58	92
Gresley	Early	13	20	14	0	15	12	15	20	14	40	14	30	91
Nabawa (Control)	Midseason ...	14	48	15	36	17	12	16	24	15	4	15	49	100
Merredin ...	Early	16	48	15	44	18	0	17	28	15	52	16	46	106
Carrabin ...	Early	14	48	14	40	16	24	18	16	17	36	16	21	100
Nabawa (Control)	Midseason ...	14	56	16	32	17	4	17	44	15	4	16	16	100
Geeralying ...	Very Early ...	13	12	14	24	15	4	16	8	13	52	14	32	89
S. H. J. ...	Early	16	24	17	4	17	28	19	52	20	0	18	10	116
Nabawa (Control)	Midseason ...	14	56	16	24	15	52	16	0	14	32	15	21	100
Noongaar ...	Very Early ...	15	4	15	28	15	36	14	16	16	40	15	25	100

JUNE PLANTING.

Planted 18th June, 1928. Seed—45lbs. per Acre. Superphosphate (22%)—112lbs. per Acre.

Variety.	Maturity.	Computed Yield per Acre.										Average Yield.		Percentage.
		Section 1.		Section 2.		Section 3.		Section 4.		Section 5.				
		bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	%
Noongaar ...	Very Early ...	19	12	19	20	17	52	17	12	12	40	17	15	92
Nabawa (Control)	Midseason ...	19	4	20	0	20	0	18	0	16	24	18	42	100
S.H.J.	Early	16	16	17	4	18	24	15	52	14	8	16	21	87
Geeralying ...	Very Early ...	16	24	16	48	17	12	14	0	13	4	15	30	80
Nabawa (Control)	Midseason ...	20	16	19	44	21	44	18	56	15	36	19	15	100
Gluyas Early ...	Early	15	12	15	28	19	12	17	52	13	36	16	16	84
Canberra ...	Early	17	36	18	32	18	40	18	40	14	16	17	33	90
Nabawa (Control)	Midseason ...	20	24	20	0	19	52	20	16	17	12	19	33	100
Merredin ...	Early	13	44	17	4	17	36	17	20	13	4	15	46	81

These results show that the yields obtained from the varieties planted in June were slightly better than those obtained from the plots planted in May and April, and also that the plots planted in May yielded better than those planted in April.

In the section planted in April it will be noticed that, except in two instances, when a midseason and an early variety showed to advantage, the yields obtained were very even. In the section planted in May, although all varieties yielded well, the highest yield was obtained from an early variety.

In the June planted plots, however, the control (midseason variety), showed to advantage, which is contrary to expectations.

As the results are for one year only it is unwise to draw any definite conclusion but to be guided by past experience, which has shown that it is inadvisable to plant early varieties in April, and that for late planting an early or very early maturing variety is most suitable.

COPPER POWDERS FOR THE PREVENTION OF BUNT IN WHEAT.

B. L. SOUTHERN, A.A.C.I.,
Government Chemical Laboratory.

E. J. LIMBOURN,
Seedsman, Merredin Experiment Farm.

Further investigations have been conducted on Copper Carbonate dusting powders as described in this Journal.* Experiments have been made with the same samples with a view to determining the specific reasons for some powders showing marked superiority over others, thus facilitating the fixing of standards for the physical and chemical compositions of these materials.

A lot of work has been done in an endeavour to discover what factors are influencing the rate of solubility of the copper compounds in the soil solution surrounding the dusted wheat grain. The authors would appreciate any information as to the lethal dose of copper for Bunt spores (*Tilletia levis*); if a certain amount of copper in solution will accelerate the germination of the spores, or again whether the germination of the spores is retarded sufficiently long for the seedlings to withstand attack.

Very few of the copper dusts purchased in the market are basic copper carbonates, the majority being mixtures of basic carbonate and basic sulphate. Almost invariably the mixtures have given better results in the field than the commercially pure carbonates. One sample sold as carbonate proved to be an oxychloride.

While much information has already been obtained and hypotheses created, the fact remains that hard and fast standards cannot be recommended for the reason that the fundamental reactions are not yet understood. It is, however, reasonable to insist that the fungicides should contain at least 50 per cent. of copper if to be applied at the rate of two ounces per bushel of wheat, and the fineness should be such that the equivalent of one ounce of copper should be retained in the form of a fine powder on the wheat grains when dusted in an efficient pickler. Unless field trials show that an adulterant markedly increases the efficiency of the fungicide it should be prohibited; we know of no compound at present which would bring about such a desirable result.

Some of the samples were excluded from the 1927 and 1928 trials, but we have included "B," a commercially pure basic copper carbonate, and "D," a mixture of about one part of carbonate to three of a complex basic sulphate, together with "Smutol," an oxychloride, and "Vitrioline," a proprietary compound containing some water soluble copper. Samples "B" and "D" will be included in all future trials for purposes of comparison from year to year.

The rate of dosage of Bunt spores for the 1927 series was 20 parts of spores to 750 parts by weight of wheat, but so many of the control plants failed to reach maturity that, for 1928, the infection was reduced to 10 in 750. While earlier trials show that most of the copper dusts on sale to farmers will control the disease for lightly infected seed, it is necessary to

* 1. G. L. Sutton, Vol. III., No. 2, 1926. 2. E. J. Limbourn and G. L. Throssell, Vol. IV., No. 1, 1927.

use heavy dosages of spores to show big differences in the relative merits of the fungicides.

In 1928 five mixtures were prepared of different proportions of pure basic carbonate and basic sulphate and compared with "D" as well as "A 27," a mixture which gave good results in the field. "B 27" and "Antibunt," both basic carbonates, were also included in the series. The field trials with the mixtures, however, did not quite come up to expectations. Sample "M 3" has a composition similar to "D." It will be noticed, generally speaking, in the accompanying table that pure basic copper sulphate under the conditions of these experiments has better fungicidal properties than the basic carbonates. The basic sulphate used in 1927 contained 50 per cent. gypsum ($CaSO_4.2H_2O$) and gave very inferior results. The addition of basic carbonate to the basic sulphate reduced the fungicidal properties of the basic sulphate in the loam and increased them in the sandy soil.

The trials of 1928 were repeated in duplicate in different classes of soil. The plots were on flat country about half a mile apart and were therefore under similar climatic conditions. One soil, of similar type to that used in previous experiments, is a heavy chocolate loam of pH 7.1, and the other a poor yellow-brown sand containing a small fraction of clay and pH 5.8. The latter is not good wheat soil, but grows splendid rye. While the rate of infection in both soils is about the same for the controls, the disease is far more readily controlled in the light land than in the loam.

Small trials were also conducted in grey Perth sand containing about 3 per cent. organic matter and of reaction pH 6.1. The rate of infection of controls was high, while few of the mature infected and treated plants were diseased.

There is no doubt that the fungicidal properties of one particular fungicide depend upon the class of soil in which the dusted wheat is grown. Analysis of the water soluble extracts taken daily from different parts of the experimental plots showed marked variations, which may possibly account for the variation in counts of the same treatments in different portions of the plot. It was the exception to find an isolated bunted plant in a row, generally they appeared in twos and threes, sometimes even greater numbers being grouped together.

SUMMARY OF RESULTS.

1927 Trials. Infection 20 to 750.

Sample.	Merredin Farm. Percent bunted plants.	Chapman Farm. Percent bunted plants.
A 25, ground to pass 200 mesh sieve	75	7
A 25	77	8
A 27	61	4
B 27	77	7
B 25	77	7
C 25	69	6
D 25	63	6
E 25	70	7
F 25	60	7
Smutol	70	5
Vitrioline	82	16
Basic copper sulphate and gypsum	71	11
Control	*	60

1928 Trials. Infection 10 to 750.

Sample:	Merredin Farm. Loam Soil. Percent bunted plants.	Merredin Farm. Sandy soil. Percent bunted plants.
Antibunt	57	12
Mixture 5	31	4
Copper Hydroxide ...	31	3
A 27	26	3
B 27	51	7
B 25	33	3
Mixture 1	20	4
D 25	12	*Nil*
Mixture 2	29	3
Mixture 3	27	3
Smutol	48	3
Vitrioline	41	12
Basic copper sulphate...	21	6
Mixture 4	31	2
Control	83	91

* Owing to the great loss of plants due to secondary causes the controls were not counted.

PARTIAL CHEMICAL AND PHYSICAL COMPOSITION OF THE COPPER DUSTS.

Sample.	Percentage Cu.	Percentage CO_2.	Percentage Combined SO_3	Percentage Water soluble SO_3.	Percentage Cl.	Density lbs. per cub. foot.	Percentage retained on 200 mesh sieve.
A 25	46·48	0·88	0·43	3·83	17·09	63·2	43·6
B 25	50·04	17·64	·49	2·54	...	58·5	0·6
C 25	51·08	11·94	6·41	0·98	...	61·0	17·5
D 25	49·88	2·00	17·03	0·72	...	76·9	5·15
E 25	49·76	0·56	19·92	1·61	...	68·1	7·2
F 25	53·48	6·64	12·11	0·82	...	72·2	8·3
A 27	50·4	2·2	...	...	...	89·3	...
B 27	51·44	17·96	...	...	...	53·8	...
Antibunt	52·48	19·32	...	...	...	49·0	3·8
Pure Basic Sulphate	52·3	...	16·2	...	...	...	...
Copper Hydroxide	63·0	...	...	...	...	...	...
Smutol	54·36	...	...	...	15·08	...	12·2

The mixtures were prepared by mixing increasing proportions of Antibunt to the basic sulphate in the ratios 1-11, 9, 7, 5 and 4, and passing several times with brushing through a 200 mesh sieve.

The various treatments were divided into five sets of three treatments, with a control row of infected untreated seed between each set. Each set of three treated rows could therefore be compared with two control rows, one on either side.

To overcome any possible advantage to any one treatment, due to variation in the soil, the planting was replicated five times on each class of soil.

The planting was also planned on the "Chess-board" system as shown below, each set of three treatments being shown as Set A, B, etc. The control rows were continuous through the depth of the plot, but it will be seen that the continuation of any one row provides a control for an entirely different set of treatments, thus the control rows of Set A in Section "a" become the control row of Set B in Section "b."

															Section
	Set E		Blank				Other	exp	eriment	s.					e.
	Set D		E		Balnk		A		B		C		D		d.
Control row.	Set C	Control row.	D	Control row.	E	Control row.	Blank	Control row.	A	Control row.	B	Control row.	C	Control row.	c.
	Set B		C		D		E		Blank		A		B		b.
	Set A		B		C		D		E		Blank		A		a.

METHOD OF PLANTING.

Before planting, a dressing of superphosphate at the rate of 120 lbs. per acre had been drilled in.

The rows for planting were opened out with a two-horse cultivator, three rows at once, each 2¼ links apart. All the rows for each planting were

opened out ready before planting commenced, and the whole planting completed in one day. That on the heavy soil was planted on 7th June, and on the sandy soil on 12th June. As in previous years, the seeds were planted by hand, 100 grains to each row. To avoid contamination between the various treatments the seed for each row was supplied in glass containers and planting was made direct from these containers. Each treatment was planted separately, the soil raked over the planted rows, and the hands thoroughly cleansed before commencing to plant a fresh treatment. Each seed was firmed into the soil so that the average depth when covered should be 1 inch.

Blank rows were left at intervals throughout both plantings, so that soil samples could be taken when required. These samples were taken daily for twenty days after planting, and once each week from then until the third week in August. Soil temperatures were also taken each morning for the first twenty days after planting.

During the germinating period a count was taken of the number of seedlings showing above the ground at intervals of 10 days until 30 days after planting. During the early stages of growth evidence was again found pointing to the control of the seedling rot (*Pleosphaeria semenperda*), the disease being found only in the control rows, as in previous years. It was also noted that the disease only appeared after a crust had formed on the soil, due to heavy rain. While it was possible to keep the rows inter-cultivated the disease did not appear, but during July, when the rains were too regular to permit of cultivation, quite a number of plants became affected.

This disease would probably not be noticed in a paddock planting, but it may be the cause of "thin patches" that appear during the season, and is another reason for the thorough use of copper dusts as a fungicide. The main indication of its presence is the stunted appearance of the seedlings, the leaves of which commence to rot at the surface of the soil, rapidly turn brown, and die.

Observations of growth of the plants were made from time to time, but owing chiefly to the slow, irregular germination, no definite comparison could be made between the various treatments and the controls.

On the heavy soil, at maturity, there appeared to be a slight difference in favour of the plants in the treated rows, although no difference could be noted between the treated rows and the rows planted with clean seed. This would seem to point to Bunt having a stunting effect on the plants, but when we consider the percentage of Bunt appearing in the treated rows, this fact is not very definite.

To obtain the results of the experiment, all Bunt-infected plants were first cut back, leaving about a foot of straw standing. These butts were then counted, each row being taken separately, and then a count taken of the clean plants that had been left complete.

From these figures the percentage of infection was calculated, and a comparison made between each treatment and the control rows. Infected plants only were counted: should only one head be bunted, then the fungicide has failed to function properly.

CHEAP PASTURE PRODUCTION.

G. K. BARON-HAY,
Assistant Superintendent of Dairying.

In 1920 the Department of Agriculture issued a Bulletin* dealing with factors which were considered essential for the successful establishment of the Dairying Industry in the South-West portion of this State. A leading position was then given to the economical production of permanent pasture. It was pointed out that in heavily-timbered country the cost of clearing such land "lock, stock and barrel" was too high, and a method of establishing pasture with a minimum of clearing or cultivation was advocated. At that time this practice met with very little support.

Illustration 1.
G. McCarthy, "Richon," Armadale. First year treatment stony hill country. Subterranean clover seed, 2lbs. per acre. Superphosphate, 1 cwt. per acre.

In 1923 a campaign advocating the fertilising of pastures with a phosphatic manure was launched which brought into prominence the great value of Subterranean Clover for the production of good pasture under the

* "Success of Dairying in the South-West." P. G. Hampshire.

most unpromising conditions. Topdressing pastures with a phosphatic fertiliser, usually superphosphate, may now be said to be a general practice throughout the pastoral districts, and the results obtained have induced farmers to realise that pasture can be established on many types of land with very little clearing or cultivation, and at a fraction of the cost originally thought necessary.

There are large areas of land, embracing several soil types, lying in the district between Armadale to Busselton, on which useful pasture may be very cheaply established.

ROUGH HILLY COUNTRY.

Excellent results may be obtained on the slopes of the Darling Range escarpment, where the soil is of granitic or dioritic origin, below the lateritic caps.

These hills are usually too steep or stony for cultivation, and do not pay to clear, though generally the timber is open in character. (See Illustration 1.)

By ringbarking the timber where necessary, slashing scrub if thick, and putting through a fire, and then sowing Subterranean Clover seed, good pasture may be cheaply established. The writer has seen good results with clean Subterranean Clover seed and also with seed in the "burr." As it is often impossible to drive a drill or broadcaster over this country, the use of clean seed is advocated at the rate of 3 lbs. per acre. The seed may be mixed with the superphosphate (one bag per acre), and the two applied at the one operation. Where "burr" is used the fertiliser must be applied after the seed, and on rough country there is a difficulty in fertilising the same spots as where the "burr" has been scattered. Other points in favour of the use of clean seed are given later in this article. A broadcaster of the type which is driven from the back of a cart does useful work on this type of country, wherever a cart can be driven.

These soils being well drained are warm in the winter time, and supply pasturage earlier than do the wetter flats below them. They do not, as might be expected, carry the feed green as long into the spring as the latter, but are greatly appreciated by cattle during the winter, which are found on these hills in preference to the flat country.

Where the ground is of a hard nature, it is advisable to delay sowing the seed and fertiliser till after the first winter rains, as if a dry spell should follow the germination of the seed, there would be a danger of the seed malting. There is little danger once the roots have penetrated the ground. Mr. H. Throssell, Greenmount, has obtained good results on hill country without any clearing work at all, the clover thriving among the scrub, which is not thick, and only averaging two feet high. Mr. G. McCarthy, "Richon," Armadale, has also obtained good results with clean seed, on dioritic land, so stony that it is difficult to walk over. Mr. W. E. White, Wokalup, has some fine pasture on hill land, some of which has been established without burning or clearing, and some of which has been rung and burnt before sowing. On these areas, and on others which might be quoted, land which, until quite recently, was looked upon as of little value from a pasture point of view, may now be considered good early winter grazing.

NORTH DANDALUP TO WAGERUP.

Lying between these two centres, in addition to land usually considered suitable for the production of crops and pasture, there stretch areas of flat sandy loams, overlying clay at a depth of usually one to two feet, and which, owing to their being waterlogged (often completely inundated, in the rainy season), have been in the main left severely alone.

The timber consists of stunted Jarrah, Blackboys and Christmas Trees. East of Pinjarra, to the hills, the timber becomes more open and the clay reaches almost to the surface.

Illustration 2.
Graves Mitchell, Harvey. First year treatment, no clearing and under green timber. Light gravelly loam overlying clay. Photo. taken 18 weeks after sowing subterranean clover.

The effect of ploughing such land for the sowing of crops or pasture has been to puddle it so badly that very poor results are obtained for some time after being broken up. It is also unable, after being ploughed, to carry stock until well into the spring. Good results have, however, been obtained by pulling the blackboys, ringing trees where necessary, burning, and then sowing Subterranean Clover seed, without ploughing, or at the most, running a disc harrow over the land before sowing. Mr. Hobart Tuckey, Pinjarra, has led the way in his district, and others are now following his example.

Mr. Tuckey, in 1926, sowed an area of 18 acres without even burning the scrub after the blackboys had been pulled, using 1½ lbs. of clean Subterranean Clover seed and one bag of superphosphate per acre. Growth was slow the first year owing to the light dressing of seed, but when inspected last year, after having been topdressed annually with one cwt. of

superphosphate per acre, presented a uniform mass of fodder 18in. high, consisting almost solely of Subterranean Clover and Drooping Flowered Clover. This latter clover seems ubiquitous on all this wet low-lying land, and soon makes its appearance after phosphatic fertilisers have been applied.

Illustration 3.
Type of country being successfully treated at Pinjarra. Thin layer soil overlying grey clay. Waterlogged in rainy season.

An area alongside the above field, which had been sown by the then orthodox method of ploughing and cultivating before seeding showed results not comparable with those obtained by the cheaper method. (See Illustration 4.)

Mr. W. E. McLarty in 1927 layed down 30 acres of similar land without ploughing with good results, but prefers to disc cultivate prior to sowing the seed and fertiliser.

In the writer's opinion 1½ lbs. of clean seed is too light, and 3 lbs. per acre is recommended to be sown after the first rains have started.

EXPERIMENT IN PASTURE ESTABLISHMENT, DRAKESBROOK.

At the request of the North Drakesbrook Progress Association an experiment has been commenced on the above type of land to demonstrate several points of value in the cheap development of pasture. Although the experiment is not yet completed, several useful facts have been demonstrated.

Ploughed versus Unploughed Land.

At the end of the growing period the growth of clovers was good on all plots, but a far earlier growth was obtained on the unploughed areas, and gave a greater bulk of fodder in spring. For grazing it would have been impossible to have grazed the ploughed plots, as the stock would have buried the young plants in the soft earth. The ground, however, where it had not been ploughed would have carried stock at any time of the winter. From the point of view of cost also the unploughed land has the advantage.

Pasture Plants to Sow.

Various pasture plants were sown to demonstrate which plants would provide good returns on this type of soil. The mixtures included Subterranean Clover, White Dutch Clover, Crimson Clover, Lotus Major, Per-

Illustration 4.
Hobart Tuckey, Pinjarra. Country similar to that depicted in Illustration 3, in third season of treatment. (See letterpress.)

rennial Rye Grass, Paspalum Dilatatum, and Cocksfoot. It was apparent from the growth during the winter and spring that for the quick establishment of pasture on this type of country and under rough conditions, Subterranean Clover alone should be relied upon, at least in the few initial years.

Clean Subterranean Clover seed or in the "burr."

The Department has always advocated the use of clean seed in the sowing of Subterranean Clover, and the experiment was designed to demonstrate that as good results could be obtained from the use of clean seed,

with other advantages, as from the sowing of seed in the "burr," which practice has been favoured by the majority of farmers. (See Illustration 5.)

Clean seed was sown at the rate of 4 lbs. per acre, which was estimated to give the same amount of seed as was contained in the sample of "burr" which was used. On the Field Day held in November to inspect these plots, there was very little difference to be noticed between the two, if anything it was in favour of the clean seed, which was more evenly distributed over the area. The superphosphate was applied at the rate of 200 lbs. per acre. Where clean seed is used care should be taken to sow after the first rains have started, especially if the ground be hard. The sowing of these plots was carried out early in May.

It is claimed that equally good results can be obtained from clean seed as from "burr," together with a number of very definite advantages, enumerated below.

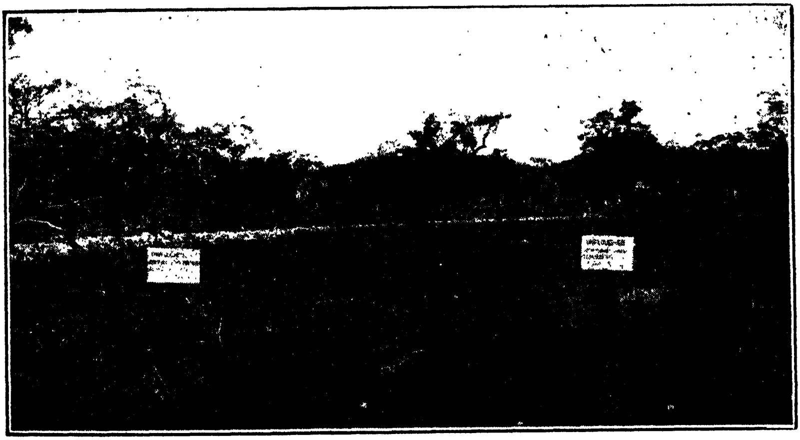


Illustration 5.
Demonstration Plots on Mr. O. Bowles' farm, Waroona, to show relative merits clean subterranean clover seed and "burr" for sowing on uncultivated land. (Left: Seed in "Burr." Right: Clean Seed.)

1. When purchasing clean seed, the purchaser is protected by the provisions of the Pure Seeds Act, by which the vendor must state the percentage of viable seeds, and also the percentage of weed seeds. When purchasing "burr" seed this is impossible, as this class of seed is not sold by registered seed merchants, but by individual farmers. It is also quite impossible to tell by inspection that one has a good sample of viable seed in the burr. This was forcibly brought home to the writer when inspecting a clover cleaning plant. Two samples of clean "burr" were seen, which in appearance presented very few differences, but on being threshed out yielded very different quantities of clean seed, as the following figures show. Both samples were grown on the same type of land, in fact, on adjoining farms.

Seed obtained from two samples of "Burr" similar in appearance.

Sample A—

"Burr," 40 bags; clean seed, 510 lbs.; value of bag at 2s. 3d. per lb. Clean Seed, 28s. 8d.

Sample B—

"Bur," 40 bags; Clean Seed, 1,300 lbs.: value of bag at 2s. 3d. per lb. clean seed, 73s. 1½d.

These figures explain the conflicting reports obtained as to the bulk of feed obtained the first year after sowing Subterranean Clover with "burr" seed.

2. Clean seed may be inspected for seeds of undesirable weeds, notably Dodder. This is difficult with "burr." There is good evidence that the remarkable spread of some weeds in the South-West during the

Illustration 6.
A field at Harvey showing folly of sowing subterranean clover seed in "burr." Field infested with "Yellow Weed" (Bartsia trixago var.). Adjoining fields are clean.

last few years has been through their carriage in bags of "burr" clover seed. (See Illustration 6.) The great bulk of these weed seeds are removed in the process of winnowing and separating the husk from the clean seed. Moreover, vendors of clean seed inspect the paddocks from which their "burr" is obtained, and do not thresh the seed from badly-infested paddocks.

3. The rapid spread of the Red Legged Earth Mite and the Lucerne Flea through the clover-growing districts may possibly be ascribed to the

transference of their eggs in the bags of "burr"seed. This point, however, has not been definitely proved.

4. Clean seed can be applied more cheaply and evenly than in the "burr." Clean seed is usually mixed with the fertiliser for sowing, and provided this is not done more than four hours before sowing no ill effects will result. The seed and the fertiliser are therefore deposited together on the ground. With "burr" the ground must be traversed twice, and the fertiliser is often deposited where there is no seed, especially on rough country.

5. The percentage of germination is higher with clean seed than with seed in the "burr." Seed in the "burr" may show as low a percentage germination as 30 per cent., while 90 per cent. germination is not unusual with a good sample of clean seed. This is because the small, ill-shaped and light seeds are removed during the process of cleaning, only the good sound seed appearing in the final sample.

CLAY FLATS, COOKERNUP-BRUNSWICK-WATERLOO.

Probably no soils have responded more rapidly to cheap methods of pasture production than have the clay soils situated at the foot of the Darling Ranges. In their unimproved condition these soils carry Red Gum timber, thick fibrous scrub averaging two to three feet in height, and are badly water-logged in the winter months.

After drainage good results are obtained by burning the scrub, and applying Subterranean Clover seed at the rate of 2 to 3 lbs. per acre, together with 1 cwt. to 1 bag of superphosphate per acre. On these soils it is important where clean seed is being used, and which is recommended, that the application of seed and fertiliser be delayed until the soil is damp, as otherwise there is a danger of the young root not being able to force its way into the stiff soil, which are extremely hard when dry. The use of clover seed in the "burr" is only recommended where the farmer has gathered his own "burr," and is thus certain that no undesirable weed seed or pests have been on the area from where the seed has been gathered.

The success of this method of establishing pasture on any soils by this method depends to a great extent on judicious stocking the first year. Stock should not be allowed on the area being treated the first year until the plants have seeded and the clover seeds have "rooted," and therefore cannot be pulled up by stock when eating the runners. At this stage heavy stocking is recommended, so as to assist in destroying the young scrub which is sure to have sprouted during the winter months.

It is believed that by adopting these rough but economical methods for the production of feed, the whole area of the farm can be made productive in a comparatively short period. Areas successfully laid down by this method may be seen on the farms of Messrs. O. E. Titley, Brunswick, who has 100 acres now under good pasture established by this method; F. Reeve, Brunswick, who has been able to rake seed from an area now in its third year; O. Rath, Harvey, an old established farmer, but who is adopting these new methods in the development of a new area recently acquired; C. C. Leitch, Trigwell Estate, Boyanup, now milking over 20 cows, who has not

used a plough for the sowing of any pasture (see Illustration 7); and C. M. Scott, Elgin, one of the largest dairymen in the State.

Illustration 7.
C. C. Leitch, Trigwell Estate, Boyanup. Yellow clay country, of little value till drained. Mr. Leitch has established all his pasture without ploughing.

This method of rapidly bringing the land into profit enables the dairy farmer to have very little unproductive land on the farm, and when the whole is thus bringing in revenue, the work of total clearing can be continued, and the farm gradually brought into a fully improved condition.

FARMERS' FIELD TRIALS, 1928.

G. L. THROSSELL,
Dipl. Agric., Agricultural Adviser.

At Lake Brown (J. Mulqueeny).

The trials this year were a continuation of the previous trials, with the addition of the early variety (Geeralying) in the Variety Trial.

The land on which the trials were conducted was a typical red loam, originally carrying Salmon Gum and Gimlet timber. It was fallowed to a depth of 3-4 inches in August, 1927, with a disc implement (Sundercut), cultivated with the same implement about the end of August, and again on 28th April and with a springtyne after rain on 19th May, and it was also harrowed after rain on 22nd May.

The plots, which were each half an acre in area, were duplicated, and were planted on 28th and 29th May. In the variety trial the wheat was planted at the rate of 45 lbs. per acre and superphosphate at 75 lbs. per acre. The variety Noongaar was used in the rate of seeding trial, and superphosphate at 75 lbs. per acre.

The rainfall, as officially recorded to the end of October, is as follows:—

	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total, May to Oct.
Lake Brown ..	31	..	50	89	89	85	189	97	30	..	490

The dry spring, summer, and autumn left little or no reserves of moisture in the soil. The rains during the growing period were below the average and were characterised by light showers followed by heavy winds. The winter passed without a good soaking downpour. September was a particularly trying month, severe frosts being recorded during the first week, and only 30 points of rain were recorded, spread over seven days, the highest fall being eight points. No rain fell during October and the total for the growing period was 490 points. The results of the trials are tabulated below:—

Wheat Variety Trial, 1928.

Seed—45lbs. per acre. Superphosphate—75lbs. per Acre. Planted 28th May, 1928.

Variety.	Section 1. Yield per Acre.	Section 2. Yield per Acre.	Average, 1928. Yield per Acre.	Average, 1927-28. Yield per Acre.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
S.H.J.	2 56	2 50	2 53	7 36
Gluyas Early	5 36	5 52	5 44	9 50
Geeralying	4 16	3 26	3 52	...
Gluyas Early	5 52	6 16	6 4	9 50
Noongaar	4 58	4 32	4 46	8 42

Rate of Seeding Trial.

Variety—Noongaar. Superphosphate—75lbs. per Acre. Planted—29th May, 1928.

Rate of Seed.	Section 1.	Section 2.	Average, 1928.	Average, 1927-28
	Yield per Acre.	Yield per Acre.	Yield per Acre.	Yield per Acre.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
30 lbs.	4 22	6 6	5 14	9 48
45 lbs.	4 16	5 16	6 26	9 46
60 lbs.	4 4	4 2	4 4	9 42

These results, which are for a period of two years only, confirm those obtained at other centres, where the very early varieties have not displaced the early variety, Gluyas Early, as the most suitable for districts of low rainfall.

At East Goomarin (E. Randolph).

The trials conducted this year were a repetition of last year's, with the exception that the variety Geeralying was added to the Variety Trial—the rate of seeding trial being unaltered.

The soil was a fine red loam, originally carrying Morrell, mixed with Salmon and Gimlet. It was fallowed in June, 1927, with a disc implement to a depth of 3in. and the growth of self-sown wheat, in the absence of sheep, necessitated it being reploughed three times, these operations being completed in August. A springtyne cultivator was used on the 15th September, 3rd October, 25th May and 5th June. The mulch was in good tilth, the seed bed well consolidated, free of weeds and had a good moisture content.

The plots were planted on June 5th and 7th, seeding having been delayed a week on account of rain. The variety trial was sown at the rate of 45lbs. of seed and 80lbs. of superphosphate applied to all plots. The wheat was dry pickled with copper carbonate. The variety Noongaar was used in the Rate of Seeding Trial, 80lbs. of superphosphate per acre being applied to all plots.

The rainfall as officially recorded to the end of October is shown in the accompanying table:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total, May to Oct.
					May.	June.	July.	Aug.	Sept.	Oct.	
East Goomarin ...	84	...	51	80	121	93	182	163	79	...	638

The spring, summer, and autumn months were very dry and the seeding rains were very late. All the rain fell in light showers during the growing period and the winter was passed without good soaking rains, leaving no reserves of moisture in the soil. The months of September and October were very critical ones, no rain being recorded in the latter month, and 79 points only in September, spread over a number of days.

The results are shown hereunder:—

Wheat Variety Trial.

Seed—45lbs. per acre. Superphosphate—80 lbs. per acre. Planted—6th June.

Variety.	Section 1.	Section 2.	Average, 1928.	Average, 3 years 1926–27–28.
	Yield per Acre.	Yield per Acre.	Yield per Acre.	Yield per Acre.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
S.H.J.	7 16	7 20	7 18	11 36
Gluyas Early	10 56	11 16	11 16	15 16
Geeralying	9 28	9 32	9 30	...
Gluyas Early	11 16	11 58	11 36	15 16
Noongaar	10 6	9 46	9 56	13 40

Rate of Seeding Trial.

Variety—Noongaar Superphosphate—80lbs. per acre. Planted—7th June, 1928.

Rate of Seed per Acre.	Section 1.	Section 2.	Average, 1928.	Average, 2 years, 1927–28.
	Yield per Acre.	Yield per Acre.	Yield per Acre.	Yield per Acre.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.
30lbs.	9 54	11 8	10 32	12 16
45lbs.	11 16	10 42	11 0	12 50
60lbs.	10 4	10 16	10 11	12 46

These results, which are for a period of three years, show that the variety Gluyas Early has yielded the best over this period, and that both Noongaar and Geeralying show promise as very early varieties, suitable for late seeding. In the rate of seeding trial, which has been conducted for two years, 45lbs. of seed per acre has given the best returns, although the difference between the different rates is not great. It does indicate, however, that there is no advantage to be gained by increasing the rate of seeding above 45lbs. per acre.

At North Kununoppin (A. E. Hughes).

Two trials were conducted on this property, namely, a Wheat Variety Trial and a Rate of Superphosphate Experiment.

The soil was a friable loam, originally carrying Jam, Salmon Gum, and Gimlet. It was ploughed with a disc implement (Sundercut) to a depth of 4ins. in June, 1927, cultivated with the same implement in August, with a springtyne after rain, 4th May, and again prior to seeding on 15th May. The plots, which were planted on the 15th and 16th May, were each half an acre in area and were duplicated.

Seed was applied at the rate of 45lbs. per acre on all plots, and was dry pickled with copper carbonate. 90lbs. of superphosphate per acre was applied to all plots in the Variety Trial and at the required rates in the Rate of Superphosphate Trial.

The rainfall recorded to the end of October is shown hereunder:—

——	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total, May to Oct.
					May.	June.	July.	Aug.	Sept.	Oct.	
N. Kununoppin ...	125	...	58	91	125	73	266	145	51	8	668

The season has been one of the most phenomenal since 1914. No rains of any consequence fell during the spring and summer apart from 125 points in January. The autumn rains were very light and did not afford an opportunity of destroying weed seeds or preparing a seed bed. The seeding rains were very late, but a useful rain fell after the plots were planted, resulting in an even germination. From then on until the middle of July the rains were very sparse, and the wheats made very little progress, giving the weeds a chance. Good rains fell during July and August, but September and October were exceedingly dry, forcing the wheats into ear. Noongaar came into ear about the middle of August, Geeralying on the 24th August and S.J.H. and Gluyas Early during the first week in September. Despite the absence of rain, the mild weather towards maturity minimised to a great extent the formation of pinched grain.

The tabulated results are as hereunder:—

WHEAT VARIETY TRIAL.

Seed—45lbs. per acre. Superphosphate—90lbs. per acre. Planted 16th May.

Variety.	Section 1.		Section 2.		Average.	
	Yield per acre.		Yield per acre.		Yield per acre.	
	bus.	lbs.	bus.	lbs.	bus.	lbs.
S.H.J.	19	48	13	32	16	40
Gluyas Early	19	50	19	11	19	31
Geeralying	19	1	14	31	16	46
Gluyas Early	19	11	14	52	17	2
Noongaar	19	25	18	38	19	3

RATE OF SUPERPHOSPHATE TRIAL.

Variety—Gluyas Early. Seed—45lbs. per acre. Planted 15th May.

Rate of Super.	Section 1.		Section 2.		Average.	
	Yield per acre.		Yield per acre.		Yield per acre.	
	bus.	lbs.	bus.	lbs.	bus.	lbs.
150 lbs.	16	50	17	17	17	4
75 lbs.	14	25	15	43	15	4
225 lbs.	16	5	15	27	15	47

As this is the first year that trials have been conducted here, no definite conclusions can be made. The results of the variety trial, however, are substantiated by trials at other centres. Considerable variation in the plots of the superphosphate trial, due to hard patches, reduces the accuracy of the trial.

JUNIOR FIELD TRIALS, 1928.

E. J. LIMBOURN,
Seedsman, Merredin Experiment Farm.

These trials were planted on similar lines to those of previous years, both wheat and oats being included.

Each variety was sown down two tubes of the drill, a drill width containing five varieties with the control variety Gluyas Early on either side.

The length of the plots as planted, was 10 chains, which was later subdivided into 10 sections of 87 links, with a division of four links between each section, the balance of the plot forming a headland.

Three of these sections were harvested as hay, six for grain and one was left standing, so that information regarding the strength of straw and ability of the different varieties to hold their grain could be obtained.

The oat section of the trials was planted on 8th May and the wheat section on 19th May.

At time of planting the fallow contained very little moisture, and germination was both slow and irregular. However, there appeared to be very little malting, the final germination being generally good.

The seed was sown at the rate of 45lbs. with an application of 120lbs. of superphosphate per acre.

The season has been one of low rainfall, with long dry spells at critical periods. The monthly rainfall records are as follow, July and August being the only two months to exceed the average:—

—	Jan.	Feb.	Mar.	Useful Rains.								Nov.	Dec.	Year
				Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1928 ...	39	...	101	58	76	107	224	154	71	19	709	...	24	873
Average...	56	50	113	76	124	174	186	135	97	80	872	36	59	1,186

Following on a very dry summer, April had only four wet days. The highest daily registration was 53 points on the 28th.

May was without rain until the 20th, and had only four wet days. The highest daily fall was 25 points, registered on the 30th.

Between 30th May and 2nd June 61 points fell, followed by 61 points between 6th and 9th June, these two falls being responsible for the majority of the germination.

June had altogether nine wet days, the highest daily fall being 57 points on the 9th.

Only four points fell between June 9th and 29th, s spell of nearly three weeks, causing a serious check to the young seedlings.

Rain fell fairly regularly during July, there being 17 wet days. 70 points were registered on the 9th, but the average daily fall for the wet days of the month was only 13 points.

August averaged 14 points per day for the eleven days on which rain fell, the highest being 64 points on the 5th.

38 points fell on 3rd September, otherwise the rain was very light, although there were altogether 11 wet days during this month. There were

two spells of six days without rain, so that after the 3rd of the month practically no useful ran fell.

October had two wet days only, 17 points on the 13th and two points on the 21st.

Several severe frosts were recorded during the latter part of September and early October, light frosts continuing right throughout October.

Fortunatey, temperatures during September and October were exceptionally low, fairly good dews or frost appearing every night. This, no doubt, helped the later varieties to mature normally, and although the ears of such varieties were badly tipped, the mature grain was of a better sample than from earlier varieties.

As would be expected, growth generally was shorter than usual, ears were small and only matured two grains to each spikelet.

Very marked variations occur in the yields from the different sections. This appears to be due mainly to soil variation and partly to the presence of patches of Take-all. Weed growth was neglgible. Flag Smut was found in "Gluyas Early" and the new crossbred M 32 (Florence x Fortune). Take-all attacked all varieties, more or less, although it was very noticeable that in a bad patch of the disease, the variety "Noongaar" had suffered much less than varieties on either side of it.

The outstanding feature of this season is the success of the new crossbred wheat M. 20 (Nabawa x Gluyas Early), both as regards the yields for hay and grain, and its resistance to Flag Smut, as shown in the resistance test carried out with that disease.

Several other crossbreds show great promise, but this one stands out prominently, and easily excels all other varieties under test.

Brief notes regarding the characteristics of the varieties tested are given below:—

Wheat Varieties.

Carrabin P. 1437.

Type:—White, tapering compact ear, strong straw, usually of medium height. Grain is classed as Premier Strong White, and compares very favourably with Comeback. Yields well in normal years, but is very tough to strip. Very resistant to disease. Maturity—Early.

This is one of the varieties distributed by the Department of Agriculture under their Pure Seed Scheme. It was included in the test for comparson with the new crossbreeds having good quality grain.

C. 74 *D.A.C.* 4179 *x Quality.*

Type:—White, tapering ear, fairly compact, with tip awn. Inclined to lodge a little, and also to shed its grain. Grain—strong white, rather pinched this season. Resistant to Flag Smut and Bunt, liable to Take-all. Maturity—late mid-season.

This is variety bred at the Chapman Experiment Farm and is apparently not suitable for our drier conditions. During 1927 it showed marked resistance to the Root-rot (*Wojnowicia graminis*) that was prevalent that season, but was badly attacked by Take-all (*Ophiobolus graminis*) this year.

M. 28 (*Dindiloa x Nabawa*).

Type:—White, tapering ear, fairly compact, with tip awn. Strong straw, does not shed. Fairly resistant to Bunt and Flag Smut.

This variety is being discarded in account of probable difficulty in stripping, being, if anything, worse than Carrabin.

M. 30 (*Dindiloa x Nabawa*).

This is quite similar in type to M. 28 and like it, is difficult to strip.

M. 18 (*Federation x Bunyip*).

Type:—Brown, tapering ear, rather open, with tip awn. Lodges rather badly and inclined to shed. Grain rather poor. Resistant to Flag Smut, but liable to Bunt. Maturity—very early.

This variety is being discarded on account of weak straw.

M. 24 (*Florence x Carrabin*).

Type:—White, tapering ear, compact, without awn. Good straw, does not shed. Grain Premier strong white. Further selection for a free stripping strain will be carried out with this variety.

M. 32 (*Florence x Fortune*).

Type:—White, tapering ear, fairly compact, with tip awn. Straw of good height and stands well, does not shed its grain. Liable to Bunt and Flag Smut. Maturity—Early. A very promising type, especially for hay, but requires further selection for resistance to disease.

M. 33 (*Florence x Nabawa*).

Type:—White, tapering ear, fairly compact, tip awns. Stands well, average height; does not shed its grain. Liable to Bunt, but resistant to Flag Smut. Maturity—Early.

A very promising crossbred, with strong milling grain. Free stripping and has yielded rather better than Carrabin this season.

Gluclub P. 1787.

Type:—Brown, clubbed ear, very compact, with tip awns. Stands up well, but is inclined to shed a little. Very liable to both Bunt and Flag Smut. Maturity—Midseason.

A selection by Messrs. Smith & Sons, of Yarding, W.A. Yields well, but very disease liable.

M. 31 (*Gluyas Early x Nabawa*).

Type:—White, tapering ear, compact, with tip awn. Stands up well, does not shed. Liable to Bunt, but resistant to Flag Smut. Maturity—Midseason.

Has yielded rather better than Nabawa, which it closely resembles. Very promising.

M. 14 (*Nabawa x Bunyip*).

Type:—White, tapering ear, fairly compact, with tip awn. Tall growing and stands fairly well, does not shed. Liable to Bunt, but very resistant to Flag Smut. Maturity:—Very early, about a week earlier than Gluyas Early.

A very promising type for districts with a short season. Not as early as "Noongaar," but has given rather better results this season. It is a selection made at Merredin Experiment Farm from a cross made at the Chapman Experiment Farm in 1918.

M. 26 (*Nabawa x Carrabin*).

Type:—White, tapering ear, fairly compact, without awn. Stands up well, medium height, does not shed. Shows immunity to Flag Smut, but is liable to Bunt. Maturity—Midseason.

This should prove a useful variety, having a strong milling grain, free stripping and yielding well. It has immunity to Flag Smut of its parent type, "Nabawa," and in quality of grain is about equal to Carrabin.

M. 20 (Nabawa x Gluyas Early).

Type:—White, tapering ear, fairly compact, with tip awn. Slender semi-solid straw, similar to Gluyas Early, stands fairly well, does not shed. Grain strong white, very like Nabawa. Liable to Bunt, but highly resistant to Flag Smut. Maturity—Early.

Here is a variety that promises to prove equal or better than Gluyas Early for yield, both of grain and hay. Its resistance to Flag Smut gives it a big advantage over that variety and if further trials are consistent with this season's results, it should prove a very useful variety.

The original cross was made at the Chapman Experiment Farm in 1918 seed from the first (F1) generation being sent to this farm for selection. The type known as M. 20 was fixed in 1924 and has since then been under observation without showing any variations.

Noongaar P. 1769 (W.A.).

Type:—White, tapering ear, small, rather open, without awns. Slender semi-solid straw, medium height, stands fairly well. Does not shed. Liable to both Bunt and Flag Smut. Maturity—Very early.

This variety is the most recent introduction by the Department of Agriculture and is proving itself of value in the wheat areas east of Merredin. On account of its quick growth, it can be planted late without any danger from a lack of spring rains.

Patriot P. 1463 (Q).

Type:—White, tapering ear, rather open, without awn. Stands up well, but is inclined to shed a little. Susceptible to both Bunt and Flag Smut. Maturity—Early.

In previous trials this variety showed rather promising, but apparently it requires a fairly consistent rainfall to bring it to maturity normally. Its susceptbility to the Smut disease is also a big disadvantage, and it is not proposed to carry the trials with this variety any further.

Ranee P. 1697 (Vict.).

Type:—Brown, tapering ear, compast, with tip awn. Short, stout straw, stands well, does not shed. Very suspectible to both Bunt and Flag Smut. Maturity—Late-midseason. Yields rather well, but is too disease liable.

C. 51 (Toby's Tusk x Gluyas Early).

Type:—White, square tipped ear, fairly compact, with tip awn. Rather tall growing, and inclined to lodge. Maturity—Early.

Results of trials very disappointing—cannot stand up to dry conditions.

Waratah P. 1627 (N.S.W.)

Type:—Brown, tapering ear, rather open, with tip awn. Tall growing, but stands well, inclined to shed a little. Susceptible to both Bunt and Flag Smut. Maturity—Midseason.

This variety has given good yields for three seasons, and is evidently productive under our conditions. It is hoped, by crossbreeding, to improve its disease resistance, and overcome its liability to shed its grain.

Oat Varieties.

C. 72 (Algerian x Sunrise).

A new crossbred oat from the Chapman Experiment Farm. Made rather better growth than Algerian in the Test Row plantings but is altogether too late for our conditions.

C. 93 (Algerian x Ruakura).

Another new crossbred from the Chapman Experiment Farm unsuitable under our conditions.

Belar P. 1740 (N.S.W.)

Not suitable for light rainfall districts, being rather later than Guyra. Its actual yield, however, compares very favourably with that variety, and it would probably give good results with a moderate rainfall. It has a very fair quality grain, light in colour, and rather stout straw.

Buddah P. 1632 (N.S.W.).

A good early variety of the "Sunrise" type. Not equal to Mulga under our condiitons.

Gidgee P. 1737 (W.A. selection from a N.S.W. variety).

Very similar to Guyra, but matures earlier and has given better results this season than that variety.

C. 87 (Lachlan x Sunrise).

Rather better than C. 72 and C. 93, but still not very promising.

Palestine Oats P. 1716.

Short in straw, very quick growing. Of use only as a grain producer; very prolific. Grain somewhat like Algerian, dark brown, very coarse hulls.

P. 1724 (Un-named Oat).

This is an oat sent to us by Mr. R. N. Bell, Agricultural Bank Inspector, of Balingup, for identification. It has been identified as an early strain of "Burt's Early."

The results of the trials, as given in the following tables, are of use only as an indication of the possible comparative productivity of the different varieties. Every care is taken to keep the yields as accurate as possible, but the loss in threshing is too irregular for any definite yield per acre being stated.

The area harvested per section of any one variety is approximately 1/640 of an acre, the total area per variety being:—

6/640ths. of an acre for grain and 3/640ths of an acre for hay.

The plots are harvested by hand, each section and variety being cut separately and the sheaf or sheaves labelled.

For hay the varieties are cut as near as possible at the same stage of maturity and the sheaves stooked in the paddock until sufficiently dry for carting. Each sheaf is then weighed to the nearest ¼lb. and the weights recorded.

For grain the varieties are not cut until they would be fit for stripping. When cut the sheaves are stooked until it is convenient to thresh them by means of a small peg-drum thresher and winnower machine. The yield of grain from each section is naturally very small, and to get the results of the trial as accurate as possible, weights are taken to the nearest ⅛th of an ounce.

JUNIOR FIELD TRIALS, 1928.
MERREDIN EXPERIMENTAL FARM.
Summary of Results with Wheat Varieties.

Variety.	Reg. No.	Season of Maturity.	Average height in inches.	Percentage Yields.	
				Grain.	Hay.
Carrabin	P. 1437	Early	36	83	83
(D.A.C. 4179 x Quality) ...	C. 74	Late midseason ...	34	80	80
(Dindiloa x Nabawa)	M. 28	Early	36	81	81
(Dindiloa x Nabawa)	M. 30	Early	36	101	99
(Federation x Bunyip) ...	M. 18	Very early ...	38	79	74
(Florence x Carrabin)	M. 24	Early	38	72	84
(Florence x Fortune)	M. 32	Early	43	96	106
(Florence x Nabawa)	M. 33	Early	36	85	91
Gluclub	P. 1787	Midseason	40	114	103
Gluyas Early	P. 159	Early	40	100	100
(Gluyas Early x Nabawa) ...	M. 31	Midseason	39	101	84
Nabawa	P. 1432	Midseason	40	97	79
(Nabawa x Bunyip)	M. 14	Very early ...	42	96	86
(Nabawa x Carrabin)	M. 26	Midseason	40	93	81
(Nabawa x Gluyas Early) ...	M. 20	Early	40	122	110
Noongaar	P. 1769	Very early ...	40	88	85
Patriot	P. 1463	Early	40	81	96
Ranee	P. 1697	Late midseason ...	38	92	78
(Toby's Tusk x Gluyas Early)	C. 51	Early	39	81	87
Waratah	P. 1627	Midseason	40	99	97

COMPARATIVE PERCENTAGE YIELDS OF WHEAT VARIETIES PLANTED FOR TWO OR MORE YEARS.

Grain—Gluyas Early = 100 per cent. yield.

Variety.	Reg. No.	Comparative Percentage Yield.				Average.
		1925.	1926.	1927.	1928.	
(Dindiloa x Nabawa)	M. 28	...	...	97	81	89
(Dindiloa x Nabawa)	M. 30	...	...	91	101	96
(Federation x Bunyip) ...	M. 18	93	25*	86	79	86
(Florence x Carrabin)	M. 24	...	...	88	72	80
(Florence x Fortune)	M. 32	...	...	93	96	94
(Gluyas Early x Nabawa) ...	M. 31	...	...	91	101	96
(Nabawa x Bunyip)	M. 14	60	81	82	96	80
Patriot	P. 1463	...	...	98	81	90
Ranee	P. 1697	...	...	83	92	87
Waratah	P. 1627	...	99	91	99	96

* Badly affected by Septoria, not included in average results.

Hay—Gluyas Early = 100 per cent. yield.

Variety.	Reg. No.	Comparative Percentage Yield.				Average.
		1925.	1926.	1927.	1928.	
(Dindiloa x Nabawa)	M. 28	...	...	83	81	82
(Dindiloa x Nabawa)	M. 30	...	...	97	99	98
(Federation x Bunyip) ...	M. 18	85	85	77	74	80
(Florence x Carrabin)	M. 24	...	...	83	84	84
(Florence x Fortune)	M. 32	...	...	87	106	96
(Gluyas Early x Nabawa) ...	M. 31	...	...	93	84	88
(Nabawa x Bunyip)	M. 14	67	88	79	86	80
Patriot	P. 1463	...	...	93	96	94
Ranee	P. 1697	...	...	81	78	80
Waratah	P. 1627	...	113	99	97	103

SUMMARY OF RESULTS WITH OAT VARIETIES.

Variety.	Reg. No.	Season of Maturity.	Average height in inches.	Percentage Yields.	
				Grain.	Hay.
(Algerian x Ruakura)	C. 93	Late	25	28	51
(Algerian x Sunrise)	C. 72	Late	28	39	93
Belar	P. 1740	Late	28	72	84
Buddah	P. 1632	Early	34	94	92
Burts Early	P. 1494	Early	34	100	100
Gidgee-	P. 1737	Early	34	96	97
Guyra	P. 1250	Midseason	28	81	88
(Lachlan x Sunrise)	C. 87	Late	20	39	...
Mulga	P. 1185	Early	36	115	107
Palestine	P. 1716	Early	33	127	80
Unnamed	P. 1724	Early	35	111	108

NOTE.—Palestine made about normal growth—all other varieties very stunted.

POTATO TRIALS AT BUREKUP, 1928.

G. N. LOWE,

Senior Potato Inspector.

Experiments in potato fertilisers and in seed potatoes were conducted recently by the Department of Agriculture on the property of Mr. C. L. Clarke, at Burekup. These trials were undertaken on similar lines to those which have been carried out in former years in the same area. In the fertiliser trials varying quantities of either nitrogen, phosphoric acid or potash were used in comparison with a standard control mixture. This control mixture consisting of 1,430 lbs. Super, 500 lbs. Sulphate of Ammonia, and 210 lbs. Sulphate of Potash per acre has been used in many experiments, because it offers a starting point for the variations of plant food under consideration. In these trials, moreover, it proved one of the most successful of the manures used. This mixture supplies to the soil in actual plant food 300lbs. of Phosphoric Acid; 100lbs. Nitrogen and 100 lbs. Potash. For practical purposes it could be regarded as a mixture of 14 cwt. Super, 5 cwt. Sulphate Ammonia and 2 cwt. Sulphate Potash. The results obtained from these field trials should be of interest to potato growers in this and in other areas.

Land similar to that in which the trials were carried out is very common in many parts of the South-Western area. It is typical of that usually found in cleared Red Gum and Jarrah districts, and consists of a very light red sandy loam. This particular area had been under cultivation for potatoes and was down in Subterranean Clover pasture for some years. During the year prior to experiment the paddock was pastured.

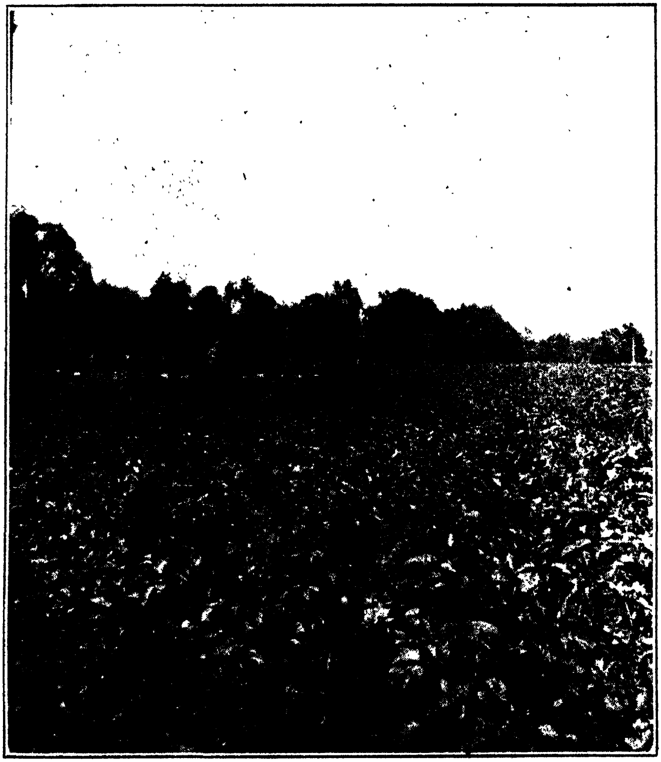
The seed used for planting was certified seed, obtained from Mr. F. Tonkin, of Young's Siding, in the Albany district. For some while this Department has advocated the use of seed from the Southern district for planting in the South-Western areas. This seed, which is grown in the cooler parts of the State, seems to be less affected with mosaic and other virus troubles than seed from the South-Western district. This practice of bringing seed from a cooler district is general in many of the potato areas in other parts of the world. It was justified in this particular instance, for the general average of the plots was approximately seven tons per acre, whilst the yield of the rest of the paddock, which was not planted with either Southern or Certified Seed, was only three tons per acre. The Certified Seed was shapely and of fair size and the tubers were cut into 2oz. sets, treated by the wet bag method and then planted.

In addition to the fertiliser trial, a seed experiment was conducted.

In this test twelve plots were taken and in six of them the seed was planted straight off knife, and in the other six the seed was treated with the wet bag process. A difference of five cwt. per acre in favour of the treated

seed was noted. This would show that even in winter planting, when the ground is quite wet, it pays to treat cut seed with the wet bag treatment. The additional time occupied in preparing the seed is, therefore, adequately repaid by the extra crop of potatoes obtained. The actual results obtained were 6 tons 16 cwt. 3 qrs. 6 lbs. per acre from the treated and 6 tons 11cwt. 2 qrs. 10 lbs. from the untreated.

The experimental area was ploughed about 5 inches, the sets placed about 3½ inches below the surface, and the fertiliser was applied in the



Showing the vigorous type of plant from Certified Seed in the Burekup Fertiliser Trial.

furrows. The planting was finished on 11th July. The subsequent cultivation consisted of two cultivations on the flat, then the potatoes were hilled and hoed twice. During the early growing period the weather was very cold and wet and consequently the crop was slow in making growth. A great deal of damage was also done by the red-legged earth mite, which was very prevalent, owing to the weather conditions. An attempt was made to combat this pest by laying flaked napthaline at the rate of 1 cwt. per acre along

the rows with a fair measure of success. In view of the prevalence of Irish Blight in the metropolitan area, it was deemed advisable to spray with a commercial preparation of Bordeaux mixture (in powder form) towards the end of the growing period. The crop was finally dug 27th November.

In the Potash Series the variations used were 415 lbs., 210 lbs., and 0 lbs. per acre. From the table given below, it will be seen that the highest yield, viz., 7 tons 5 cwt., was obtained from the plot containing the greatest amount of potash per acre. This is rather interesting, for there is an idea prevalent throughout the potato growing areas that it is not necessary to

The type of plant grown in the paddock surrounding the Burekup Fertiliser Trial and planted at the same time. Mosaic infection is general now in this old strain of local seed.

add potash to the fertiliser. In the trial, a difference of £1 9s. per acre in the cost of manure due to the extra potash above that of the control mixtures gives an increase of 6 cwt. of potatoes per acre. If we assume the average price of potatoes grown at this time of the year to be £10 per ton, a profit of about £1 10s. per acre is obtained. A reference to the table shows that

there was a graded increase in yield as the potash was increased from 0lbs. to 415 lbs. per acre.

Manure used per Acre.	Amount of Potash in lbs. per Acre.	*Cost per Acre.	Yield per Acre.
		£ s. d.	T. C. Q. L.
415lbs. Sulphate Potash ... 500lbs. Sulphate Ammonia ... 1,430lbs. Super	200	11 4 11	7 5 2 22
210lbs. Sulphate Potash ... 500lbs. Sulphate Ammonia ... 1,430lbs. Super	100	9 15 11	6 18 1 16
0lbs. Sulphate Potash ... 500lbs. Sulphate Ammonia ... 1,430lbs. Super	1	8 5 11	6 13 0 20

*The cost per acre was worked out on the basis of £16 per ton for Sulphate Potash, £6 per ton for Super and £20 per ton for Sulphate of Ammonia. This is the current market rate, *ex* Perth.

The difference noted in the nitrogen series would seem to indicate that no great benefit is derived from increasing the weight of the Sulphate of Ammonia from 200 lbs. to 500 lbs. per acre, though the highest yield was obtained from the plot containing the greatest amount of Sulphate of Ammonia.

Manure used per Acre.	Amount of Nitrogen in lbs. per Acre.	Cost per Acre.	Yield per Acre.
		£ s. d.	T. C. Q. L.
500lbs. Sulphate Ammonia ... 210lbs. Sulphate Potash ... 1,430lbs. Super	100	9 15 11	6 16 2 12
350lbs. Sulphate Ammonia ... 210lbs. Sulphate Potash ... 1,430lbs. Super	70	8 9 2	6 7 0 26
200lbs. Sulphate Ammonia ... 210lbs. Sulphate Potash ... 1,430lbs. Super	40	6 17 11	6 14 2 2

On the other hand, some of the evidence seems to show that 500 lbs. of Sulphate of Ammonia is somewhere in the neighbourhood of the right amount. The highest yield was that derived from the mixture containing 500 lbs. Sulphate of Ammonia, 1,430 lbs. Super. and 415 lbs Sulphate Potash. The result obtained from this mixture can be compared with that from a similar mixture containing only 200 lbs. Sulphate of Ammonia. It would seem that for an expenditure of £2 18s. in Sulphate of

Ammonia a return of about 12 cwt. of potatoes per acre is obtained. On the £10 basis for potatoes, this is a profit of £3 per acre.

Manure used per Acre.	Amount of Nitrogen in lbs. per Acre.	Cost per Acre.	Yield per Acre.
		£ s. d.	T. C. Q. L.
500lbs. Sulphate Ammonia ... 1,430lbs. Super ... ... 415lbs. Sulphate Potash ...	100	11 4 11	7 5 2 22
200lbs. Sulphate Ammonia ... 1,430lbs. Super ... ... 415lbs. Sulphate Potash ...	40	8 6 11	6 14 0 8

A study of the results given below for the super trials shows that an increase of super. in the mixture from 1,430 lbs. to 1,907 lbs. per acre did not increase the yield. This result would seem to run contrary to the opinion held by many growers, who maintain that an increase in super. means an increase of yield.

Manure used per Acre.	Amount of Phosphoric Acid in lbs. per Acre.	Cost per Acre.	Yield per Acre.
		£ s. d.	T. C. Q. L.
1,907lbs. Super ... ... 500lbs. Sulphate Ammonia ... 210lbs. Sulphate Potash ...	400	11 1 5	6 13 0 20
1,668lbs. Super ... ... 500lbs. Sulphate Ammonia ... 210lbs. Sulphate Potash ...	350	10 8 7	6 6 3 4
1,430lbs Super ... ... 500lbs. Sulphate Ammonia ... 210lbs. Sulphate Potash ...	300	9 15 11	6 19 2 21

A detailed account of the manures used, the yield per acre, and cost per acre is given in the diagram accompanying this article.

Summary.

1. Certified Seed is a payable proposition for potato growers.

2. When seed potatoes have to be cut before planting, it is better to treat them with the "Wet Bag" method.

3. The best result was obtained from a mixture containing 415 lbs. Sulphate of Potash, 1,430 lbs. Super. and 500 lbs. Sulphate of Ammonia.

POTATO FERTILISER EXPERIMENT. JULY-NOVEMBER 1928 at BUREKUP.

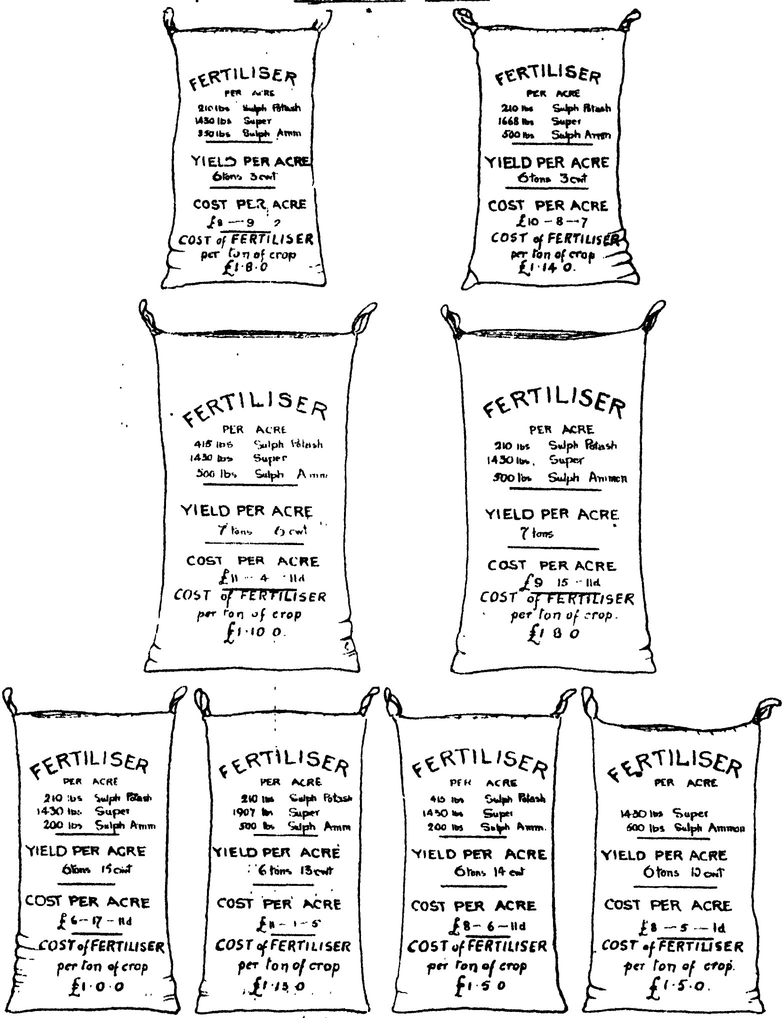


Chart showing fertilisers + composition, yield per acre, + cost of fertiliser per ton of crop.

PRODUCTION AND CONSERVATION OF FODDER.*

P. G. HAMPSHIRE,
Superintendent of Dairying.

In discussing this subject, and there is not the slightest doubt that it is of the utmost importance to the Australian dairying industry, it must be borne in mind that conditions regarding production and conservation of fodder would vary in different parts of Australia.

Whilst much could be done through the Dairy Organisations of Australia in the direction of financing in regard to better bulls, it is difficult to suggest any scheme of finance which would enable the farmer to be financed in regard to the storage of fodder on his holding. Any system of storage or conservation of fodder other than on his own holding would not be practicable, although in concentrated dairying districts a system of conserving fodder in the shape of silage in overhead silos may be possible, but there are many features which would militate against the easy working and success. It would seem, then, that the question of adequate supply of fodder for the dairy herds of Australia throughout the dry and the drought periods must be, more or less, dealt with individually, and local conditions of soil, climate, and suitability of crops or pastures must be taken into consideration. The subject, therefore, can only be taken on broad principles, and I offer for discussion the following:—

PRODUCTION.

The production of forage for dairy herds would come under three headings:—

1. Pasture.
2. Supplementary Fodder Crops.
3. Concentrated Foods.

Pasture.—There is no doubt that this form of production of fodder for dairy cows ranks highest, in view of the economy of production, elimination of labour costs and suitability of the fodder for dairy cows. Ideal pastures, however, are governed by climate and soil, and suffer during dry and drought periods.

Apart from the improvement of pastures by proper care and management, such as small paddocks, constant changes, harrowing down animal manure, *under-* rather than over-stocking, there is the very important factor of improving pastures by top-dressing at least annually with phosphatic fertilisers. This form of increased fodder production is one that of recent years shows the greatest economic return.

Top-dressing with superphosphate over a period of four years on 65 areas in different centres of Western Australia shows an average increase as follows:—No manure, 100%; 1 cwt. superphosphate per acre, 263%; 2 cwt. superphosphate per acre, 330%; and still further the "quality" of pastures has been improved by the addition of leguminous plants as the result of the use of phosphatic manures to the following extent:—No manure, 100%; 1 cwt. superphosphate, 260%; 2 cwt. superphosphate 300%.

* Notes prepared for discussion at Meeting of Australian Dairy Council, Melbourne, 27th February, 1929.

Supplementary Fodder Crops.—Under this heading, crops such as:—(a) Clovers; (b) Lucerne; (c) Maize; (d) Sorghum; (e) Millets; (f) Sudan Grass; (g) Tangier Pea.

On almost all classes of country under varying climatic conditions, crops could be selected from the above-mentioned to grow at various periods of the year to supplement the pastures.

It is believed that the need of conservation of fodder would be minimised to a great extent if supplementary fodder crops were properly grown and formed part of the recognised operations of the farmer in the feeding of his herd, and it is felt that in this respect, the greatest amount of work can be done, particularly with the small dairy farmer, in meeting the dry periods of the year and times of drought.

In the consideration of supplementary fodder crops for summer and winter feeding the following are recommended:—

Summer Feeding.—Meadow Hay (dry); Clover Hay (dry); Lucerne (green); Millet (green); Sudan Grass (green); Maize (green); Sorghums (green); Tangier Pea (green).

Winter Feeding.—Lucerne Hay (dry); Clover Hay (dry); Meadow Hay (dry); Oaten Hay (dry); Pea Hay (dry); Sorghum (green), late cuttings; Barley (green): Berseem Clover (green); Oats (green).

Concentrated Foods.—The principal of these are Bran, Crushed Oats, and Linseed Meal.

There is a distinct disadvantage in regard to concentrated foodstuffs, inasmuch as, on the majority of dairy farms, they cannot be produced. Oats, however, is a crop that can be grown almost generally, and oat grain when crushed forms a concentrated food almost parallel with bran for feeding cows, and where fed with clover hay and green maize or sorghum forms an economical and suitable ration for a dairy cow.

Other concentrated foodstuffs are not dealt with in view of the fact that the majority of them must be purchased.

CONSERVATION.

The conservation of fodder would come under two principal headings:—

1. Hay.
2. Silage.

Hay.—Lucerne; Meadow; Clover; Oaten; Wheaten; Pea.

Silage.—Maize; Sorghum; Oats and Peas; Oats; Wheat.

Forms of Silage.—Stack; Trench; Pit; and Overhead, or Tub.

In regard to the conservation of fodder crops, there is no doubt that the simplest forms of conservation are in the shape of conserving crops as hay, and on almost any dairy farm different types of hay may be made. Hay, however, has one distinct disadvantage from the point of view of feeding the dairy cow inasmuch as it lacks succulence. As feed during the winter and as part ration when fed with silage, it is, however, very valuable. Silage, on the other hand, is probably the most economical and most suitable form of roughage that can be stored for dairy cattle. Almost all types of country will grow crops that are suitable for silage, whether they be winter or summer

crops. Silage has the great advantage that it may be stored in large quantities close to the place of feeding; it is free from damage by vermin; and it will not burn or deteriorate through keeping if properly made.

The different ways in which silage can be made also enable the dairy farmer with different types of country and limited means to avail himself of this "greatest insurance" he can have against drought and dry periods.

It must be borne in mind, however, that in the case of the stack and trench silos, the losses in the material ensiled are considerable, especially in stack silage.

According to the material made into a stack, the losses will vary from 30 to 35 per cent. and even greater where the stack is badly made and the material not cut at the right time. However, as so often happens in the dairying districts of Australia, there are periods when there is an abundance of feed when, if the farmer were to take advantage of those periods of abundance and cut and stack, the losses of the material in the stack would be a mere bagatelle compared with the losses in condition and milk yield which occur in his herd through lack of succulent feed in times of dry periods and drought.

A trench silo is only suitable in country which does not seep, and is built on the principle of the construction of a dam for water. Beyond the expense incurred in excavating the soil to form the trench, the cost is very small, especially where the farmer does his own excavation.

In regard to the pit silo, this type is not recommended in view of the fact that the cost of construction is proportionately nearly that of an overhead silo where permanence is desired, and it has the great disadvantage that all the material in the silo must be lifted each day when it is being fed to the herd. Anyone who has to feed silage to a large herd of, say, 70 to 100 cows from this type of silo will appreciate that the hoisting of upwards of one ton of material daily is by no means an easy task. The pit silo has one great advantage, and that is it does not require an elevator to lift the material when filling, but as the chaff-cutting machine for silage purposes is usually fitted with a blower or elevator, this is not a very big consideration.

It is essential that pit silage should be chaffed small, as otherwise the emptying of the pit in the case of long material becomes a very strenuous and difficult task owing to it becoming so densely matted. In the case of the stack and trench silage, the material is not chaffed but can be more readily cut out with special knives in a "face" than is the case with a pit silo.

The overhead or tub silo takes many forms of construction, such as concrete, brick, stone, iron, fibro-cement, or wood. The principal factors, however, to ensure success are that the material used must be impervious to the air, should be circular—free from any corners or corrugations on the inside, and at least two feet high for each foot in diameter, with provision for doors at frequent intervals to provide for economy of emptying. Where a farmer can arrange for the erection of this type of silo or silos, placing them at or adjoining the bails, it presents the most efficient and economical form of feeding dairy stock where conservation must be practised.

The value of silos on dairy farms, particularly as a part of the equipment of the holding, has not been thoroughly appreciated by farmers and especially by banking institutions when considering loans to their clients to develop their holdings. It forms the soundest and best possible security to the banker on a holding, as it guarantees that the stock carried on the holding

will not depreciate at any period of the year through lack of feed, and if the losses which occur annually in Australia through the lack of feed were totalled in pounds, shillings and pence, it is believed that a sufficiently large sum of money would be available to finance the erection of a silo on almost every dairy farm. Apart from the fact that many dairy farmers do not sufficiently appreciate the advantages of the conservation of fodder as silage and a silo on every farm, it is felt that the bankers of Australia might with considerable advantage be asked to meet the dairy organisations with the view of discussing this very important phase of stabilising the dairying industry in Australia.

Bulletins Nos. 208 and 184—"Pastures"; 216—"Fodder Crops"; and 211—"Silage: Ensilage and Silos" are available.

LUCERNE AND MAIZE.

It is felt that a realisation of the great value of these two fodder crops is not fully appreciated by the average dairyman. Lucerne and maize rank highest of all fodder crops in supplementing pastures during the summer

Lucerne,
grown at Brunswick, providing six to seven cuts per annum.

months. Both provide bulk of feed and succulence and grow during the period when the pastures are drying up, and, when fed together at the ratio of 1lb. of lucerne to 6lbs. of maize, a reasonably balanced ration is obtained. There are very few farms in the South-West that will not grow these two crops if proper preparation and cultivation of the soil are observed.

It is generally recognised that lucerne requires a deep soil with a good well drained subsoil. That, however, this crop will do well in soils that are shallow and do not have first-class subsoils has been proved over and over again. At the Denmark State Farm a 3-acre stand of lucerne was maintained for seven years on soil that was only nine inches above stiff clay.

The main feature in securing success in the growing of this crop, as well as maize, is the thorough preparation of the seed bed obtaining a well worked up condition of the soil with a good tilth and freedom from weed seeds. The growing of intense crops, such as potatoes, prior to the sowing of lucerne or maize is of great value.

Both lucerne and maize do best on deep allavial land which retains moisture in the summer, but very good crops may be obtained on the higher lands where proper conditions of fallowing are resorted to, where the soil is well prepared, and where intertillage during the growing of the crop is practised. This latter aspect, namely, the cultivation of the ground at 10-day intervals during the growth of the crop until it reaches a height of three or four feet, is of the greatest importance in retaining moisture in the soil which has been conserved by fallowing through the winter.

Maize,
grown at Denmark, averaged 22 tons 16 cwt. per acre.

The utilisation of all farmyard manure on land where maize is to be grown is very important in obtaining good yields.

It is particularly desired to bring under the notice of dairymen the value of lucerne and maize as the main crops to be grown in their farming operations in supplying supplementary crops for their pastures to keep the herd of dairy cows yielding at their maximum throughout their lactation.

Bulletins No. 148—"Maize," and No. 149—"Lucerne," prepared by the Director of Agriculture (Mr. G. L. Sutton) are available free to all people desiring the fullest information relative to the growing of these crops.

SUBTERRANEAN CLOVER STACK SILAGE.

Recognising that a considerable amount of highly nutritious succulent fodder is grown on the average farm in the South-West of the State in subterranean clover pastures, which in the ordinary course of events is not wholly eaten by the stock owing to the abundance of the growth during September to November, certain thinking dairymen have appreciated the value of cutting this crop in its green state and making stack silage. Pioneers of this method in the State are—Messrs. Bailey Bros., of Denmark; G. Combs, S. Gray, and H. Grumpelt, Manjimup; and during the season just ended a con-

Subterranean Clover Stack Silage.
One of four stacks at Bailey Bros.' Farm, Denmark.

siderable number of the small farmers, including a number of group settlers, have built stacks of silage from subterranean clover. The success that has attained through their efforts has been varied. On 11 stacks recently examined, the losses of the material in the stacks vary from 20½ to 90 per cent., and the average of the 11 stacks inspected showed a loss of 54 per cent. of the material ensiled. Whilst recognising that this loss is particularly high and can be avoided by resorting to better methods and larger stacks, there is no doubt whatever that, with the abundance of fodder that is available during October and November, any cheap method which will provide for its conservation to feed in its green succulent form during the summer months is of outstanding advantage. The writer does not at this stage propose to dogmatise in regard to the methods that should be resorted to in order to avoid the losses that are occurring, but hopes to do so at a later date and before the next Subterranean Clover season.

There are many advantages of cutting these prolific Subterranean Clover pastures and making them into silage where this is done early in the growing season, namely:-

1. A hay crop can still be obtained towards the end of the season.
2. Pastures cut for silage at the end of September or early in October in good districts under favourable conditions, and where top-dressing is practised, will provide a very good cut at the end of November or early in December.
3. The re-growth of weeds and of noxious plants is checked.
4. A better quality hay is obtained, and additionally the hay is ready for harvesting at a later period of the year when there is less likelihood of showers- the worry of the haymaker.

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK YARDED AT METROPOLITAN FAT STOCK MARKETS FOR DECEMBER, 1928, JANUARY AND FEBRUARY, 1929.

	December, 1928.			January, 1929.					February, 1929.			
	5.	12.	19.	2	9.	16.	23.	30.	6.	13.	20.	27.
Sheep and Lambs	20,317	14.635	24,714	15,597	11,094	10.405	14.004	11.273	10.574	10.994	9,811	11,396
Cattle ...	706	566	929	612	546.	642	529	622	362	462	530	488
Pigs ...	379	745	929	310	655	661	558	617	620	669	751	711

COMPARATIVE VALUES PER LB. OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS DURING DECEMBER, 1928, JANUARY AND FEBRUARY, 1929.

	December, 1928.			January, 1929.					February, 1929.			
	5.	12.	19.	2.	9.	16.	23.	30.	6.	13.	20.	27.
Mutton ...	6¾	6¾	6¾	6¾	7½	7¼	7½	7¼	7¼	7¼	7½	7½
Beef ...	7½	8½	8½	9	9	8¾	8	7¾	8½	9	9¼	9¾
Pork ...	12	12½	12½	13	13	12	12	11½	11½	11½	11½	11½
Bacon ...	10	10	10	10	10	9¾	9¼	9	9¼	9¾	10	10

LUCERNE CROPS AT COLLIE.

Irrigated Lucerne crops grown at the Amalgamated Collieries, Limited, Mine, Collie, and the plots are situated adjacent to the mine stables and irrigated from the mine. Sown in 1927 (September), the first crop is said to have been cut in November of that year, when 18 inches high. These photos. show respectively the second and third crops taken off this year, and are stated at 3 feet 6 inches and 3 feet 9 inches respectively.

Photos. and information supplied by H. Woodward, Collie.

VARIETAL BUNT RESISTANCE TESTS—1928.

E. J. LIMBOURN,
Seedsman, Experiment Farm, Merredin.

As in the case of the Varietal Flag Smut Resistance test, this experiment was carried out with the object of obtaining definite information regarding the resistance of wheat varieties to the attacks of Bunt. This experiment is in continuance of those carried out in previous years and since 1921.

The method of infection was similar to previous years. Sufficient seed, according to the requirements, of each variety, was placed in separate packets together with a quantity of Bunt spores obtained by crushing the Bunt balls. These were well shaken up until the wheat seeds were completely covered, the Bunt spores adhering to the grain, especially in the crease and at its brush end.

Planting was delayed until early in June, for the following reasons:—

1. To ensure a fairly regular germination of all varieties after sufficient rain had fallen to obviate any possibility of malting.
2. To ensure as far as possible that soil temperature should be equally suitable for the germination of both the wheat seeds and bunt spores.

The germination was fairly good, but owing to a spell of dry weather immediately following germination, early growth was very slow. A number of seedlings died, some due to the prevailing dry conditions, but the majority were destroyed by seedling rot. The slow early growth apparently gave the bunt fungus an advantage, the resulting infection of the mature plants in many cases being very heavy.

To determine the extent to which each variety became infected, each plant was examined at maturity for the presence of the disease and the infected plants cut back, leaving about one foot of the stalk standing. Badly infected plants are quite readily identified at any time after the flowering stage, the plants being of a darker colour than normal plants and the ears having a very swollen appearance. In more resistant varieties it often happens that only a few balls of the bunt will form on the whole plant, which under test row conditions may have anything up to 10 or 15 ears, and it requires very close observation to detect these. Usually in such varieties the infection occurs in late or secondary growth, so that care was taken to examine such growth first. Having determined and cut back all the infected plants, the number of the clean and bunted plants in each row was recorded.

For purposes of this experiment, a plant is said to be infected whether the whole plant produces bunt balls or whether there is only one ball of bunt on the whole plant. It has been noticed, however, both with the disease and with Flag Smut, that the higher the percentage of infection per variety, so in proportion is the infection per plant. With Bunt, it has also been found that a variety which is highly resistant under normal conditions becomes infected to a greater extent when it receives a check to its growth as the result of less favourable growing conditions or for other reasons. On the other hand, from observations made this year, it would seem that in the case of very susceptible varieties the effect of infection was to stimulate the growth of the infected plants, for it was found that in such cases the plants

without infection were comparatively weakly. The growth of such comparatively weakly plants must, however, be regarded as quite normal when compared with the growth of normally clean plants grown from clean seed. Possibly the increased growth of the infected plants in the case of the susceptible varieties is due to a special attempt on the part of the plant to reproduce itself.

In that portion of the test in which the resistant varieties were planted, the percentage of infection of the control variety "Booran" was 46 compared with a percentage of infection of 89 in the remainder of the trial. The lessened infection of the control variety indicates that the rate of infection was favourably influenced by some factor, possibly the soil conditions, and in consequence the results with these varieties may not be normal. The results are given below:—

TABLE I.

BUNT RESISTANCE TESTS. 1928.

Variation in resistance of Varieties as shown by their Percentage of Infection when compared with a very susceptible variety "Booran."

Name.	Reg. No.	Infection per row.	Comparative Infection.
		%	%
Booran	P 1434	46	100
Genoa	P 1511	0	0
Florence	P 223	0	0
Dindiloa	P 1438	0	0
(Dindiloa x Nabawa)	C 80	0	0
S.H.J.	P 1445	0	0
Booran	P 1434	48	100
Booran	P 1434	47	100
(Huguenot x Indian 5)	C 65	8	18
(Florence x Carrabin)	C 77	0	0
(Florence x Nabawa)	C 81	2	4
(Quality x Velvet Don)	C 86	0	0
Ford	P 915	4	9
Booran	P 1434	43	100
Booran	P 1434	92	100
Amby	P 1446	77	87
Anvil	P 1195	73	83
Austral	P 1325	89	100
Babakin	P 1715	53	60
Bald Knob ...	P 1184	40	45
Booran	P 1434	85	100
Booran	P 1434	92	100
Hiawatha ...	P 1458	96	109
Indian Pusa 4 ...	P 1459	61	69
Leaks Rustproof	P 1528	92	105
Lilydale	P 1721	87	99
Mac's White ...	P 833	74	84
Booran	P 1434	84	100
Booran	P 1434	84	100
Minflor II. ...	P 1753	0	0
(Minister x Bald E. II.)	P 1745	82	92
Nabob	P 1705	40	45
Noble's Early ...	P 1428	68	76
Nullah	P 821	87	98
Booran	P 1434	96	100
Booran ..	P 1434	95	100
Bathurst .	P 220	88	96
Bayah	P 229	66	73
Bunge No. 1 ..	P 1447	96	107
(Bunge No. 1 x I. P. 9)	P 1450	84	93
Canaan .	P 913	81	90
Booran . ..	P 1434	85	100
Booran	P 1434	96	100
Cleveland ..	P 1508	98	103
(Curnawa x Minister)	P 1,752	88	98
Currimp (I.) ..	P 1,747	81	90
Currimp (II.) ..	P 1,747	85	94
Daphne ..	P 1,193	80	90
Booran .. .	P 1,434	83	100
Booran .	P 1,434	62	100
Fane .. .	P 1,191	75	84
(Federation x 1878 P 17)	P 1,755	91	105
Ghurka	P 1,713	45	52
Golden King ..	P 1,429	88	100
Golden Return ...	P 1,535	78	90
Booran	P 1,434	92	100
Booran	P 1,434	96	100
Piastre	P 1,400	4	4
Wallace	P 1,383	90	98
White Tuscan ..	P 1,516	92	100
Yandilla	P 392	58	63
Yanward ..	P 984	71	77
Booran	P 1,434	87	100

TABLE II.

BUNT RESISTANCE TESTS, 1928.

Varieties arranged according to their comparative Percentage of Infection.

Control Variety: Booran P1434 = 100%

Resistant. 0 to 25%	%	Susceptible. 26 to 75%	%	Very Susceptible. 76 to 100% and over.	%		%
Dindiloa	0	Bald Knob	45	Noble's Early	76	Nullah	98
Florence	0	Nabob	45	Yanward	77	Wallace	98
Genoa	0	Ghurka	52	Anvil	83	Lilydale	99
Minflor (Type II.)	0	Babikin	60	Fane	84	Austral	100
S.H.J.	0	Yandilla	63	Mac's White	84	Booran (Control)	100
Piastre	4	Indian Pusa 4	69	Amby	87	Golden King	100
Ford	9	Bayah	73	Currimp (Type I.)	90	White Tuscan	100
				Canaan	90	Cleveland	103
				Golden Return	90	Leak's Rustproof	105
				Daphne	90	Bunge No. 1	107
				Currimp (Type II.)	94	Hiawatha	109
				Bathurst	98		

TABLE III.

Unnamed Crossbreds arranged according to the comparative Percentage of Infection.

Control Variety: Booran P1434 — 100%

Resistant. 0 to 25%	%	Very Susceptible. 76 to 100% and over.	%
(Dindiloa x Nabawa), C80	0	(Minister x Bald Early) (Type II.), P1745	92
(Florence x Carrabin), C77	0	(Bunge No. 1 x Indian Pusa 9), P1450	93
(Quality x Velvet Don), C86	0	(Currawa x Minister), P1752	98
(Florence x Nabawa), C81	0	(Federation x 1878 P17), P1755	105
(Huguenot x Indian 5), C65	0		

Since the varietal resistance test was commenced in 1921, 153 named varieties of wheat have been tested. Of these, only one variety—"Genoa" (P. 1511)—has proved fully resistant during each year it has been tested, and therefore can be considered immune from the disease. Three other varieties—"Dindiloa" (P. 1437), "Florence" (P. 223), and "S.H.J." (P. 1445)—have been highly resistant, showing infection only under adverse conditions and in a very light form. The "Durum," or macaroni, varieties also show high resistance; those tested—"Covelle" (P. 1433), "Dauno" (P. 1544), "Huguenot" (P. 1366), "Kubanka" (P. 1211), and "Sarragolla" (P. 158)—all having a comparatively low percentage of infection.

"Carrabin" (P. 1437) has also shown high resistance under normal conditions and was at first considered a resistant variety. Continued tests have shown, however, that under certain conditions it is susceptible to the disease, although only to a small extent. The infection is seldom found in the primary growth, being confined to the secondary or late growth. In tables IV. and V. will be found the results of this test, showing the actual percentage of infection each season since its commencement. The first year, 1921, the results were very unsatisfactory, due to the method of planting. For that year the planting was carried out, as with clean seed, according to the period of maturity of the variety. Since then, however, the whole of the experiment has been planted at one time, planting being delayed until after a good fall of rain.

TABLE IV.

BUNT RESISTANCE TESTS.

Yearly results of varietal resistance as shown by Percentage of Infection.

From 1921 to 1928.

Name.	Reg. No.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	Average.	Highest Percentage Infection.
		%	%	%	%	%	%	%	%	%	%
Alliance	P1700	...	...	...	...	...	...	65	...	65	65
Alpha	P 361		96	32	...	...	...	...	...	64	96
Amby	P1446	...	...	...	...	...	...	...	77	77	77
Anvil	P1195	...	...	...	...	...	...	...	73	73	73
Aussie	P1785	...	...	...	...	...	...	45	...	45	45
Austan	P1276	...	...	44	65	45	...	...	...	51	65
Austral	P1325	...	...	...	...	...	...	...	89	89	89
Avoca	P 674	...	87	48	...	...	...	...	...	67	87
Babakin	P1715	...	...	...	...	16	...	...	53	34	53
Bald Early ...	P 986	...	...	44	70	39	82	...	89	65	89
Bald Knob ...	P1184	...	...	...	...	...	...	...	40	40	40
Barootа Wonder Early	P 859	33	69	31	64	41	...	...	...	48	64
Barwang	P1536	...	...	...	...	...	84	...	...	84	84
Bathurst	P 220	...	...	...	...	...	...	...	88	88	88
Bayah	P 229	...	...	...	...	...	...	...	66	66	66
Belka	P1443	5	72	24	...	...	...	...	...	33	72
Bena	P1614	...	...	...	...	31	71	61	...	54	71
Binya	P1789	...	...	...	...	...	...	65	...	65	65
Bobin	P1726	...	...	...	...	...	...	53	...	53	53
Boolaroo	P1727	...	...	...	...	...	...	35	...	35	35
Boonoo	P1736	...	...	...	...	...	...	50	...	50	50
Booran	P1434	...	85	70	80	70	82	78	77	77	85
Bowes (C49) ...	P1804	...	...	...	...	20	71	51	...	47	71
Bredbo	P1775	...	...	...	...	...	...	56	...	56	56
Bruce	P1790		...	...	...	...	...	57	...	57	57
Bunge No. 1 ...	P1447	...	...	...	...	...	...	...	96	96	96
Bunyip	P 421	...	58	28	...	...	...	...	...	43	58
Cadia	P1728	...	...	...	...	...	...	74	...	74	74
Caliph	P 914	6	93	34	61	19	68	...	...	47	93
Canaan	P 913	...	...	...	...	...	...	...	81	81	81
Canberra	P 709	...	90	42	59	28	72	...	...	58	90
Canimbla	P1729	...	...	...	...	...	...	56	...	56	56
Capitol	P1698	...	...	...	...	...	...	74	...	74	74
Carrabin	P1437	0	5	0	3	30	58	25	15	17	58
Cargo	P1788	...	...	...	...	...	...	53	...	53	53
Clarendon ...	P1507	...	...	34	59	32	81	...	...	51	81
Cleveland	P1508	...	...	...	...	...	...	...	93	93	93
Clubhead	P 371	...	89	...	...	...	...	...	...	89	89
Comeback ...	P 228	4	62	8	57	64	80	...	...	46	80
Confederation ...	P1696	...	...	...	...	...	79	76	...	77	79
Covelle	P1433	0	0	3	...	...	...	...	...	1	3
Crossbred No. 12 ...	P1601	...	...	28	...	...	...	...	...	28	28
Crossbred No. 78a	P1602	...	...	48	...	...	...	...	...	48	48
Cuballing	P1444	...	76	23	...	26	74	...	...	50	76
Cumberland ...	P 367	...	90	24	...	...	...	...	...	67	90
Currawa	P 522	19	57	19	59	16	75	...	...	41	75
Currimp	P1747	...	...	...	...	...	...	...	81	81	81
Daphne	P1193	...	...	...	...	...	...	...	80	80	80
Dauno	P1514	...	...	6	5	27	16	...	...	13	27
Dindiloa	P1438	...	2	...	0	0	0	...	0	0·4	2
Dollar	P1776	...	...	...	...	...	...	80	...	80	80
Dookie Delta ...	P1744	...	...	...	...	...	...	24	...	24	24
Duri	P1774	...	...	...	...	...	...	43	...	43	43
Early Bird ...	P1773	...	...	...	...	...	...	57	...	57	57
Emperor	P1202	...	...	35	77	29	...	55	...	49	77
Empire	P1702	...	...	...	...	...	...	55	...	55	55
Exquisite	P1739	...	...	...	...	...	...	52	...	52	52
Fane	P1191	...	...	...	...	...	...	...	73	73	73
Federation ...	P 460	...	74	14	56	62	58	...	...	53	74
Felix	P1512	...	...	...	...	29	...	...	...	29	29
Firbank	P 225	6	80	11	...	...	...	...	...	32	80
Florence ...	P 223	0	5	0	7	3	10	...	0	4	10
Ford	P 915	...	...	...	...	...	...	...	4	4	4
Fortune	P 911	...	58	21	...	16	54	...	...	37	58
Gallipoli	P1636	...	...	...	...	21	72	54	...	49	72
Geeralying ...	P1442	...	32	0	9	12	34	...	...	17	34
Genoa	P1511	...	0	...	0	0	0	0	0	0	0
Ghurka	P1713	...	...	...	...	...	26	11	45	27	45
Gluclub (Vic.) ...	P1754	...	...	...	...	...	...	84	...	84	84
Gluclub (W.A.) ...	P1787	...	...	...	...	...	...	67	...	67	67
Gluyas Early ...	P 159	3	70	34	56	71	78	...	...	51	78
Gluyas Late ...	P1337	0	69	28	60	14	70	...	...	40	70
Golden King ...	P1429	...	...	...	...	...	...	60	88	74	88
Golden Return ...	P1535	...	...	...	...	...	...	...	78	78	78
Gresley	P1038	5	83	54	70	59	86	...	...	59	86

TABLE IV.—BUNT RESISTANCE TESTS—*continued.*

Name.	Reg. No.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	Average.	Highest Percentage Infection.
		%	%	%	%	%	%	%	%	%	%
Hamel	P 872	9	81	42	...	...	...	...	...	44	81
Hard Federation...	P 958	10	66	19	67	44	66	...	...	45	67
Hiawatha ...	P1458	...	...	...	...	...	...	...	96	96	96
Huguenot ...	P1366	...	...	8	7	0	10	...	...	6	10
Indcret	P1750	...	...	...	...	...	...	23	...	23	23
Indian Pusa 4 ...	P1459	...	...	...	...	...	...	...	61	61	61
Krithia	P1706	...	...	...	...	...	...	28	...	28	28
Kubanka	P1211	...	...	3	...	...	...	...	...	3	3
Leaks Rustproof...	P1528	...	...	...	...	...	...	...	92	92	92
Lilydale	P1721	...	...	...	...	...	...	...	87	87	87
Lotts	P1289	28	65	42	...	...	...	...	...	45	65
Macs White ...	P 833	...	...	...	...	...	...	...	74	74	74
Mahratta	P1708	...	...	...	...	...	...	35	...	35	35
Majestic	P 21	...	...	28	71	14	...	...	...	38	71
Major	P1270	17	49	35	32	72	53	...	...	43	72
Marmora	P1709	...	...	...	...	...	...	27	...	27	27
Merredin	P1440	2	63	18	68	29	48	...	...	38	68
Minister	P 834	2	0	3	12	0	22	...	...	6	22
Minflor	P1753	...	...	...	...	...	...	...	24	24	24
Minyip	P1746	...	...	...	...	...	...	31	...	31	31
Mogul	P1703	...	...	...	...	...	87	79	...	83	87
Nabawa	P1432	0	57	14	56	38	60	42	...	38	60
Nabob	P1705	...	...	...	...	...	...	11	40	25	40
Nangeenan ...	P1436	0	84	37	71	48	89	...	...	55	89
Newman's Early...	P 955	8	88	39	68	52	79	...	...	56	88
Niloc	P1277	...	90	32	52	70	67	...	...	62	90
Nizam	P1635	...	...	...	...	0	51	...	...	25	51
Nobles Early ...	P1428	...	...	...	...	...	...	...	68	68	68
Nolba (M19) ...	P1860	...	...	...	...	55	70	...	...	62	70
Noongaar (M15) ...	P1769	...	...	...	...	10	47	...	57	38	57
Nugget	P1609	...	...	...	...	...	...	76	...	76	76
Nullah	P 821	...	...	...	...	...	...	...	87	87	87
Nungarin	P1435	0	57	38	71	25	81	...	...	45	81
Ogilvie (C48) ...	P1803	...	...	...	...	10	60	48	...	39	60
Onrah	P1741	...	...	...	...	...	...	54	...	54	54
Onas	P1513	...	...	65	...	40	77	...	...	61	77
Parsee	P1701	...	...	...	...	...	81	72	...	76	81
Patriot	P1463	...	...	...	...	...	76	75	...	75	76
Piastre	P1460	...	...	...	...	...	...	...	4	4	4
President	P1200	...	...	30	71	36	...	...	...	46	71
Queen Fan ...	P1194	...	...	7	26	51	22	...	...	26	51
Queen's Jubilee ...	P 92	3	83	54	...	...	...	...	...	47	83
Rajah (S. Aust.)...	P1201	...	...	45	62	18	...	...	...	42	62
Rajah (Vic.) ...	P1710	...	...	...	...	...	63	61	...	62	63
Ranee	P1697	...	...	...	...	...	72	61	...	66	72
Red Russian ...	P 812	12	70	27	...	...	...	...	...	36	70
Riverina	P1786	...	...	...	...	...	...	42	...	42	42
Roseworthy ...	P1190	...	...	42	42	66	57	...	...	52	66
Sailor's Fortune ...	P 465	16	64	46	...	...	...	...	...	42	64
Sarragolla ...	P 158	...	...	0	1	...	0	...	...	0·3	1
Sepoy	P1695	...	...	...	...	...	...	38	...	38	38
S.H.J.	P1445	0	8	0	1	1	17	...	0	4	17
Soutars Early ...	P1461	...	...	7	60	...	...	...	...	33	60
Sovereign ...	P1704	...	...	...	...	...	...	65	...	65	65
Steinwedel ...	P 50	47	67	32	...	...	...	...	...	49	67
Sterling	P1712	...	...	...	...	...	77	79	...	78	79
Sultan	P1199	...	...	34	73	47	75	...	...	57	75
Sunset	P 675	...	...	30	58	...	...	...	...	44	58
Suvla	P1699	...	...	...	...	...	...	16	...	16	16
Teakles	P 873	30	...	27	75	28	...	...	...	40	75
Thew	P 217	0	49	3	...	...	...	...	...	17	49
Toby's Tusk ...	P 920	0	91	42	...	...	...	...	...	44	91
Triumph	P1382	...	...	...	...	60	...	...	...	60	60
Turvey	P 257	43	65	38	70	51	81	...	...	58	81
Union	P1777	...	...	...	...	...	...	42	...	42	42
Viceroy	P1711	...	...	...	...	...	58	...	...	58	58
Wallace	P1383	...	...	...	...	...	...	...	90	90	90
Wandilla	P1182	...	...	...	...	21	...	78	...	50	78
Wannon	P1637	...	...	...	...	17	59	...	...	38	59
Waratah	P1627	...	...	...	...	23	69	53	87	58	87
Warden	P1274	...	12	74	85	...	...	...	...	40	74
Wardfir	P1756	...	...	...	...	...	...	17	...	17	17
Warren	P 153	...	...	12	62	11	...	...	...	28	62
White Tuscan ...	P1516	...	...	...	...	...	...	...	92	92	92
Wilfred	P1037	13	88	26	54	45	70	...	...	49	88
Yandilla	P 392	...	...	...	...	...	...	...	58	58	58
Yandilla King ...	P 226	16	68	27	58	35	58	...	...	43	63
Yanward	P 984	...	...	...	...	...	...	...	71	71	71
Yetna (C79) ...	P1801	...	...	...	...	...	...	7	45	26	45
Yuna	P1439	...	69	27	...	...	...	...	...	48	69

TABLE V.

BUNT RESISTANCE TESTS—1921 to 1928.

Varieties arranged according to the highest Percentage of Infection recorded during tests.

Resistant—0 to 25% infection.		Susceptible—From 26% to 75% infection.						Very Susceptible—From 76% to 100% infection.			
	%		%		%		%		%		%
Genoa	0	Dauno	27	Bruce	57	Hard Federation	67	Cuballing	76	Nullah	87
Sarragolla	1	Marmora	27	Early Bird	57	Steinwedel	67	Nugget	76	Waratah	87
Dindiloa	2	Krithia	28	Noongaar	57	Merredin	68	Patriot	76	Bathurst	88
Covelle	3	Felix	29	Bunyip	58	Noble's Early	68	Amby	77	Golden King	88
Kubanka	3	Minyip	31	Carrabin	58	Yuna	69	Emperor	77	Newmans Early	88
Ford	4	Geeralying	34	Fortune	58	Gluyas Late	70	Onas	77	Wilfred	88
Piastre	4	Boolaroo	35	Sunset	58	Nolba	70	Golden Return	78	Austral	89
Florence	10	Mahratta	35	Viceroy	58	Red Russian	70	Wandilla	78	Bald Early	89
Huguenot	10	Sepoy	38	Yandilla	58	Bena	71	Comeback	79	Clubhead	89
Suvla	16	Bald Knob	40	Wannon	59	Bowes	71	Confederation	79	Nangeenan	89
S.H.J.	17	Nabob	40	Nabawa	60	Majestic	71	Sterling	79	Canberra	90
Wardfir	17	Riverina	42	Ogilvie	60	President	71	Daphne	80	Cumberland	90
Minister	22	Union	42	Soutars Early	60	Yanward	71	Dollar	80	Niloc	90
Indcret	23	Duri	43	Triumph	60	Belka	72	Firbank	80	Wallace	90
Dookie Delta	24	Aussie	45	Indian Pusa 4	61	Gallipoli	72	Canaan	81	Toby's Tusk	91
Minflor	24	Ghurka	45	Rajah (S. Aust.)	62	Major	72	Clarendon	81	Leaks Rustproof	92
		Yetna	45	Warren	62	Ranee	72	Currimp	81	White Tuscan	92
		Thew	49	Rajah (Vic.)	63	Anvil	73	Hamel	81	Caliph	93
		Boonoo	50	Yandilla King	63	Fane	73	Nungarin	81	Cleveland	93
		Nizam	51	Early Baroota Wonder	64	Gluyas Early	73	Parsee	81	Alpha	96
		Queen Fan	51	Sailors Fortune	64	Cadia	74	Turvey	81	Bunge No. 1	96
		Exquisite	52	Alliance	65	Capitol	74	Queen's Jubilee	83	Hiawatha	96
		Babakin	53	Austan	65	Federation	74	Barwang	84		
		Bobin	53	Binya	65	Mac's White	74	Gluclub (Vic.)	84		
		Cargo	53	Lotts	65	Warden	74	Booran	85		
		Omrah	54	Sovereign	65	Currawa	75	Gresley	86		
		Empire	55	Bayah	66	Sultan	75	Avoca	87		
		Bredbo	56	Roseworthy	66	Teakle	75	Lilydale	87		
		Canimbla	56	Gluclub (W.A.)	67			Mogul	87		

VARIATION IN THE RESISTANCE OF LINES (OR STRAINS) OF TWO STANDARD VARIETIES.

This test was first carried out in 1927 with the varieties "Nabawa" (P. 1432) and "Carrabin" (P. 1437) to observe the variation in the resistance of different strains or lines of an apparently fixed variety. The results published in the "Journal" for September, 1928, showed that there is a wide range of variation between the strains—pointing to a possibility of improvement by selection.

With "Nabawa," the infection from 25% to 64% was considered too high to continue the test, and it was decided to concentrate on the variety "Carrabin." This variety only shows infection in late growth, and was at one time considered resistant. It is thought, therefore, that a resistant strain may be obtained by selection.

"Noongaar" (P. 1769) was also tested this season, but the infection was too high and the test will not be continued.

The results are as under:—

Percentage of Infection found in Two Pure Line Varieties.

TABLE VI.

Family.	Line.	Carrabin. (P. 1437).	Noongaar. (P. 1769).
		%	%
I.	a	18	52
II.	a	8	71
III.	a	8	45
I.	b	19	47
II.	b	19	41
III.	b	22	49
I.	c	5	56
II.	c	13	57
III.	c	20	55
I.	d	9	57
II.	d	10	69
III.	d	30	59
I.	e	15	67
II.	e	26	62
III.	e	17	62
Average percentage of infection per Line	...	15	57
Percentage of Infection per Family		%	%
		Family I. 12	Family I. 54
		Family II. 14	Family II. 63
		Family III. 19	Family III. 54

EXPERIMENTAL PLOTS.

RESULTS OF TOP-DRESSING, 1927.

District.	No Manure.			1 cwt. Super. per Acre.			2cwt. Super. per Acre.			Rainfall during Growing Period.	Remarks.
	Weight of Growth per Acre.	Percentage Yield of Growth.	Percentage of Clover.	Weight of Growth per Acre.	Percentage Yield of Growth.	Percentage of Clover.	Weight of Growth per Acre.	Percentage Yield of Growth.	Percentage of Clover.		
GREAT SOUTHERN LINE.	cwt.	%	%	cwt.	%	%	cwt.	%	%	inches.	
Gnowangerup	...	100	*Nil*	...	124	10	...	132	3	1,067	Weight per acre not stated.
Kojonup	...	100	33	...	225	60	...	225	72	1,643	do. do.
Mt. Barker...	...	100	38	...	385	60	...	393	64	1,930	do. do.
Tambellup	72·00	100	55	194·40	270	76	223·20	310	81	1,287	
Wickepin	...	100	*Nil*	...	134	*Nil*	...	170	*Nil*	1,068	Weight per acre not stated.
SOUTH-WESTERN LINE.											
Harvey	43·20	100	9	50·40	118	57	64·80	150	78	3,672	
Kulikup	42·80	100	75	129·40	260	84	145·80	295	87	1,932	
Busselton	14·25	100	7½	39·50	277	54	53·00	372	25	2,923	
MIDLAND LINE.											
Gingin	...	100	14	...	218	22	...	348	32	2,422	Weight per acre not stated.
Greenough	112·00	100	54	146·00	130	47	172·00	154	43	1,517	
Mingenew	64·00	100	1	140·00	219	15	194·00	303	31	1,386	
Northampton	132·00	100	2	308·00	233	14	428·00	324	16	1,819	
Three Springs	86·00	100	6	334·00	388	42	346·00	402	44	1,165	
EASTERN LINE.											
Goomalling	7·20	100	60	9·40	130	23	8·60	120	58	...	

Perth, 1st March, 1928.

Katanning, Dongarra, and Toodyay—Eaten off by Stock.

RESULTS OF TOP DRESSING, 1928.

GREAT SOUTHERN LINE.	cwt.	%	%	cwt.	%	%	cwt.	%	%	inches.
Gnowangerup	23·14	100	10	38·58	167	33	38·58	167	33	12·22
Tambellup	36·00	100	14	87·42	243	47	129·86	361	46	14·67
SOUTH-WESTERN LINE.										
Harvey	50·40	100	23	118·80	236	68	158·40	314	75	36·12
Pinjarra	52·80	100	30	110·40	209	90	148·80	282	50	33·98
Coolup	291·60	100	85	316·80	108	85	356·40	122	85	33·98
MIDLAND LINE.										
Gingin	Not taken	100	9	Not taken	219	78	Not taken	316	71	28·04
Greenough	144·00	100	33	224·00	156	48	244·00	169	51	17·68
Mingenew	82·00	100	2	176·00	215	20	224·00	273	39	14·20
Boscabel	5·14	100	Trace	46·28	900	61	110·58	2	87	20·53
Three Springs ...	68·00	100	11	234·00	344	45	212·00	312	46	12·94
EASTERN LINE.										
Goomalling...	65·24	100	55	102·86	1·5	55	123·42	186	65	11·51

Perth, 14th February, 1929.

METEOROLOGICAL INFORMATION.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
	DECEMBER, 1928.					
					inches.	inches.
Chapman State Farm	87·7	110·5	60·7	49·6	·07	·25
Geraldton	79·8	103·0	64·1	56·6	·37	·15
Walebing	89·1	107·0	57·9	44·3	1·16	·46
Perth	81·1	100·6	61·4	53·2	1·12	·56
Kalamunda	82·7	102·5	58·4	49·0	·57	·79
Bunbury	80·0	91·5	57·6	51·4	·60	·60
Bridgetown	84·8	103·8	49·9	40·0	·66	·78
Albany	70·8	82·4	56·9	47·0	·91	1·15
Merredin State Farm	89·9	107·8	60·6	43·6	·24	·60
Northam	90·0	109·3	59·8	47·1	·76	·35
York	89·1	110·0	58·8	45·0	·28	·44
Narrogin State Farm	85·6	105·5	53·7	41·5	·53	·63
Katanning	85·3	103·7	55·0	43·0	·15	·62
Cape Leeuwin ...	71·2	78·0	59·4	52·0	·70	·87

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
	JANUARY, 1929.					
					inches.	inches.
Chapman State Farm	95·0	111·3	62·9	53·8	*Nil*	·28
Geraldton	83·4	108·6	63·7	50·4	*Nil*	·22
Walebing	91·4	109·8	59·8	51·0	·77	·34
Perth	84·1	99·8	61·5	50·7	·30	·34
Kalamunda	85·2	100·3	57·9	47·0	·83	·54
Bunbury	81·0	94·8	56·1	45·2	·07	·45
Bridgetown	87·4	102·0	48·8	34·8	·05	·54
Albany	71·5	82·4	57·4	50·4	·41	·83
Merredin State Farm	90·8	106·0	59·3	46·9	·50	·58
Northam	92·3	107·0	60·7	51·5	·05	·29
York	91·4	106·0	55·1	45·0	·12	·32
Narrogin State Farm	87·0	101·5	52·1	41·6	·37	·34
Katanning	86·2	101·6	53·3	45·3	·20	·37
Cape Leeuwin ...	71·5	78·0	60·2	55·0	·08	·69

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
	FEBRUARY, 1929.					
					inches.	inches.
Chapman State Farm	89·4	110·0	63·1	51·6	·49	·52
Geraldton	84·1	108·0	66·4	54·0	·51	·30
Walebing	90·4	107·0	63·3	48·5	2·23	·47
Perth	84·8	104·3	64·6	50·4	·43	·45
Kalamunda	85·9	101·8	62·4	49·9	·69	·72
Bunbury	82·5	102·8	62·7	46·2	·52	·57
Bridgetown	87·5	105·0	54·9	42·0	1·73	·66
Albany	72·5	87·0	59·6	52·4	1·20	·96
Merredin State Farm	89·7	167·2	63·9	46·8	1·62	·53
Northam	...	...	...	...	...	...
York	90·5	104·0	59·2	42·0	·52	·47
Narrogin State Farm	86·2	99·8	56·4	41·0	·89	·58
Katanning	86·8	102·0	57·3	47·3	1·42	·57
Cape Leeuwin ...	72·6	86·0	66·2	55·2	1·04	·89

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of 613-619 Wellington Street, Perth, have supplied us with the following information regarding chaff available at the metropolitan chaff and grain auction sales held in Perth for the period December, 1928, to February, 1929 (inclusive). In all cases the prices quoted are for f.a.q. to prime wheaten chaff, packed in new bags.

December—

Quantity, 1,300 tons.
Maximum, £6 per ton.
Minimum, £5 10s. per ton.

January—

Quantity, 850 tons.
Maximum, £6 10s. per ton.
Minimum, £6 per ton.

February—

Quantity—1,450 tons.
Maximum, £6 10s. per ton.
Minimum, £5 15s. per ton.

Owing to the shortage of trucks in January, the market advanced to £6 10s. per ton, but as trucks became available at the beginning of February, values eased to £5 15s. However, a truck shortage was again experienced at the latter end of February, and the market advanced to £6 10s., the following being closing quotations:—

F.a.q. to prime—£6 to £6 5s. per ton.
F.a.q.—£5 15s. to £5 17s. 6d. per ton.
Mediums—£5 to £5 5s. per ton.

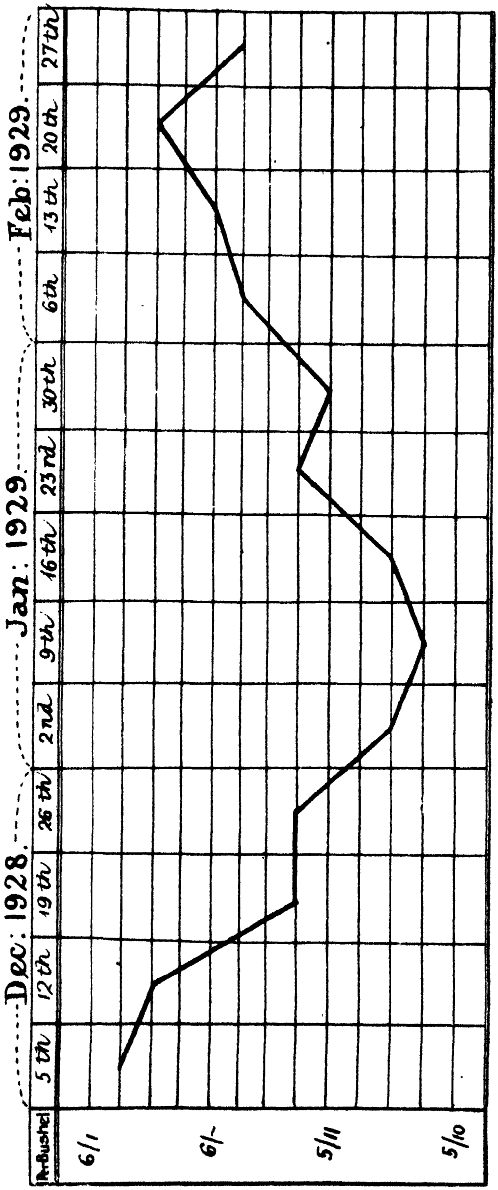
Oaten Chaff.—Right throughout December and January there was a demand for prime green samples at around £5 15s. to £6 per ton, but during February the market eased, prime quality selling at from £5 5s. to £5 10s.; mediums, as low as £4 10s.

Oats.—Supplies arriving have been sufficient to meet the demand, there being an inquiry for good heavy feed, Algerians and Guyras, at around 3s. to 3s. 3d. per bushel; light feeds, 2s. 4d. to 2s. 8d.

Wheat.—The local market is steady at from 4s. 10d. to 5s. per bushel; quality approaching this, 4s. 6d. to 4s. 8d.; inferior, lower.

Return of Wheat Prices Per Bushel

C.I.F. & E. LONDON



Compiled from figures kindly supplied by the Co-operative Wheat Pool of West. Aust.

PRODUCERS' MARKET REPORT.

The Producers' Markets, Limited, report as under for quarter ended 28th February, 1929:—

FRUIT.

At the beginning of the period supplies of fruit were steady but very short for the demand, accountable, no doubt, to the fact that the early apricot crop was very short and in some districts a failure. Values for apricots up to Christmas sales were high, touching 37s. per three-quarter bushel case for good carrying lines. Although early peaches were very poor in colour, values were firm. Valencia oranges sold also to a keen demand in this period, with lemons on the improve. Yates apples, ex cool store, were in keen demand. Cherries were also very firm throughout the first month, and strawberries steady. Tomatoes were unsteady, only carrying lines in demand. In the second month new season apples came forward, which was a welcome addition to the shortage of supplies. Plums also increased in volume, Santa Rosa variety being a popular line with buyers. Peaches and apricots continued short. Grape growers commenced operating about this time with early varieties, selling at satisfactory values. Tomato supplies increased with values on the down grade. The last month of the quarter showed many changes in the variety of fruit. Apples were very heavily supplied with mostly inferior lines, and rejects from export having a telling effect on values. A few well-coloured lines sold at fair values, considering the quantity of apples forward, but other lines were very low and hard to quit. Grapes of all varieties forward with the demand steady for good quality fruit. Tomatoes also very heavy with some lines unsaleable. Bartlett pears also added to the variety, the demand being steady.

VEGETABLES.

Supplies have been heavy during the period. Potatoes were heavy and values easy, but supplies have fallen off now, and values have firmed. Metropolitan lines are just about finished, and growers are realising high prices for the end of their crop. Country potatoes are not yet plentiful, and values are firm for any lines showing quality. Pumpkin is plentiful, and inferior lines hard to quit. Cabbage has been heavily supplied during the period, and values low. It has been an exceptional year for cabbage, and the crop has been heavy. Some of the Balcatta growers are nearing the end of their crops and values should improve. Beans have shortened in supply during the last month, and values are now very firm. Peas continued to come in in short supply, and values are steady. Brown onions are fairly plentiful, a proportion of them being second grade, and this makes the market appear erratic. Prime lines are selling well. Some prime lines of celery are now

coming forward, and values are firm for all prime lines. Cucumbers have been heavily supplied during the latter part of the month, and the demand was brisk during the hot spell. Bunch lines are shortening, but the demand has been easy. Cauliflowers are now starting to come forward, and the quality is very good for this time of the year. Values are firm. Water and rock melons have been plentiful, but values suffered considerably on account of the scare. Lettuce is well supplied, and good quality lines are firm.

EGGS.

Supplies were very heavy in the beginning of the quarter and values were low, although Western Australia was realising better prices than the other States. However, supplies are now on the decline, and in consequence market values are advancing. Export has been very disappointing this season.

POULTRY.

Good supplies have been available, but the quality has not been as good as could be desired. Owing to the hot weather this month values did not reach as high as those of last month. At present turkeys are well sought after, but are very hard to get.

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***The Handbook of Horticulture and Viticulture of Western Australia*, by A. Despeissis, M.R.A.C.**

This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible it has been reduced to 2s.

***The Pruning of Fruit Trees*, by J. F. Moody, Fruit Industries Commissioner:**

This publication contains numerous illustrations, being reproduction of photographs taken in this State, of pruned and unpruned trees, which make the details set out in the letterpress particularly easy to understand. Price 2s. 6d.

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This is a most useful and valuable book, not only for beginners, but to all those who keep fowls for pleasure and profit. It deals fully with all matters connected with the industry, including Breeding, Feeding (for stock birds or egg production), Incubating, Brooding and care of chicks, Marketing (eggs and poultry), and all matters of use to the poultry-keeper. It also fully describes symptons of various ailments and diseases and simple treatment for same, and, as the book was written to suit *local conditions*, every poultry-keeper should have a copy by him. Price, 1s.

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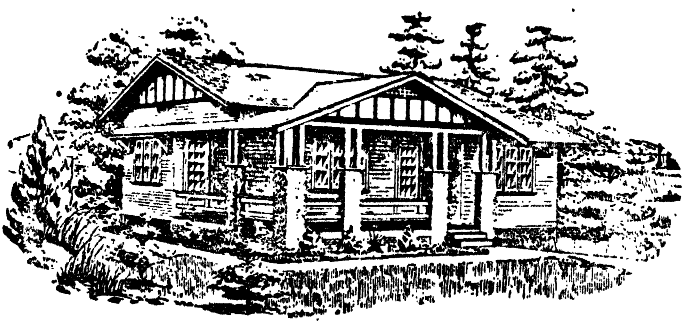

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JOURNAL

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Department of Agriculture

OF

WESTERN AUSTRALIA.

Vol. 6. (Second Series) JUNE, 1929. No. 2.

THE WHEAT PRICE SCARE.

THE EDITOR.

And those who husbanded the golden grain,
 And those who flung it to the winds like rain,
Alike to no such aureate Earth are turned
 As, buried once, men want dug up again.

Omar Khayyam—Fitzgerald.

From time to time statisticians, actuaries, students and preachers of the gospel of economy have dolefully prognosticated that with the effluxion of a few centuries, man would, as he continued to increase his progeny over the face of the Earth—completely overtake the sphere's capacity to provide him with sustenance. For the prevention of this calamity numerous theories have been prescribed, including the famous remedy of Malthus, or, not to be too pedantic, that ascribed to him. We have even been told that War, that long surviving canker of savagery in the civilised races, was a Providential happening designed to maintain the balance between man's need and the power of the Earth to supply it; yet, because there is to-day a surplus of Export Wheat in Canada, the farmer, to use a digger colloquialism, has "the wind up."

*In 1898 Sir William Crookes, a scientist of almost Universal reputation, stated that under the then existing conditions of heedless culture a scarcity of wheat was within appreciable distance; that wheat-growing land all over the world was being exhausted, and that in his opinion at some

*The Atmospheric Nitrogen Industry. Waeser—Fyleman. Foreword by J. F. Crowley, D.Sc., etc.

future time no available wheat land would be left. Crookes was then advocating the application of chemical manures to the soil—just about 30 years ago—"thus postponing the day of dearth to so distant a period that we and our sons and grandsons may legitimately live without undue solicitation for the future." The bulk of the world's average wheat production was then 12.7 bushels per acre, and the bread-eating population of the Universe was estimated at 516,500,000 people. Crookes further thought that if all the wheat-growing countries increased their cultivable areas to their utmost extent, the total, at a return of 12.7 bushels per acre, would about feed the World with its compound increase of population until 1931, and then——? With improved farming methods it might even go on until 1940.

During the intervening years much has been done in the way recommended by Sir William Crookes, and the application of superphosphates has proved of especial benefit to Australian wheat growers, while increased knowledge in the matter of dry farming and soil revitalisation has "postponed the day of dearth," yet, for the time being there is a reported surplus of wheat ready to be flooded on the immediate market, and there is a perturbed feeling amongst not a few of our farmers that wheat growing is nearing the saturation point.

That prices for wheat have fluctuated during the past few years according to seasons of plenitude and seasons of dearth may be admitted, but it must also be admitted that other factors have contributed to the fluctuation; factors not always to be found in varying seasons nor yet entirely dissociated with the get-rich-quick fraternity who have a *penchant* for various "corners." The main point is that our wheat production appears to have increased to a temporary surplus of the World's immediate requirement, and the price of the commodity may be temporarily affected thereby. It seems, however, that the demand for wheat has been increasing *parri passu* with the World's population else the price of wheat would long since have fallen in view of the increased production brought about by improved farming methods. There has been little variation during the past two decades. In the last 16 years, from 1910 to 1925, both inclusive, the mean average price for wheat in Perth has been slightly over 5s. 2d. per bushel. Is there, therefore, any need to become pannicky because of a reported surplus for export from any particular country? Is there any reason to believe that if more wheat is produced the World's markets will be limited? Is it not more likely that with increasing stocks of a valuable and palatable grain there will be an ever-increasing number of wheaten bread eaters. This is surely not an over-optimistic view if the estimate of Sir William Crookes is seriously considered, and we cannot afford to ignore the prognosis of so reputable and remarkable a scientist. Another thing worthy of consideration is that the increasing demand for wheaten bread will be governed only by the price of wheat, which will depend entirely on production costs. In a country such as Australia, and especially Western Australia, where we

have cheap land and plenty of sunlight, huge areas and modern methods of farming, there should be little fear that we cannot produce as cheaply as others. This may involve different methods of storage, handling and transport, but it is extremely doubtful if the position is nearly so acute yet as to demand conversion to silos, grain elevators and bulk handling.

Even if the gloomiest forecast were to be verified, and wheat prices were to remain at a low ebb for a season or two, it would be obviously wrong for the wheat farmer to relax his efforts of production. The lower the price the greater the necessity to produce a greater quantity from a given area, and thus make the larger volume of grain at a lower price compensate for the higher prices hitherto received for the smaller yield. In some of our districts wheat farming is as yet the only cultivation profitably possible owing to the limited rainfall and lack of water supplies for sheep, and in these areas particularly the farmer must make his best endeavours to increase the yield from his land. It is best for the farmer to concentrate on this plan of increased production, and not to unduly worry himself about the price of wheat. Experts themselves differ about the tangibility of the surplus and its effect on the World. No doubt there was a hold back of grain with a view to participation in the bonus proposed to be paid to farmers by the American Government, and the fact that this bonus is not forthcoming has released stocks and caused a sudden drop in the market price. It is notable that it has partly recovered already, and such indications as we have had during the past month are scarcely reliable. We are yet a long way from saturation point with wheat production, and seasons are apt to change and vary in different parts of wheat-growing lands, limiting the regular supply. Wheat as a commodity will hold for a long time, and can be seeped out as necessary to furnish requirements. The farmer is quite safe in renewing his energies to produce a bumper harvest this centenary year, and he need not readily read into signs of the times passing phases of supply and demand which are apt to change long before his crops are ready for the harvest.

THE POULTRY KEEPERS' MANUAL.

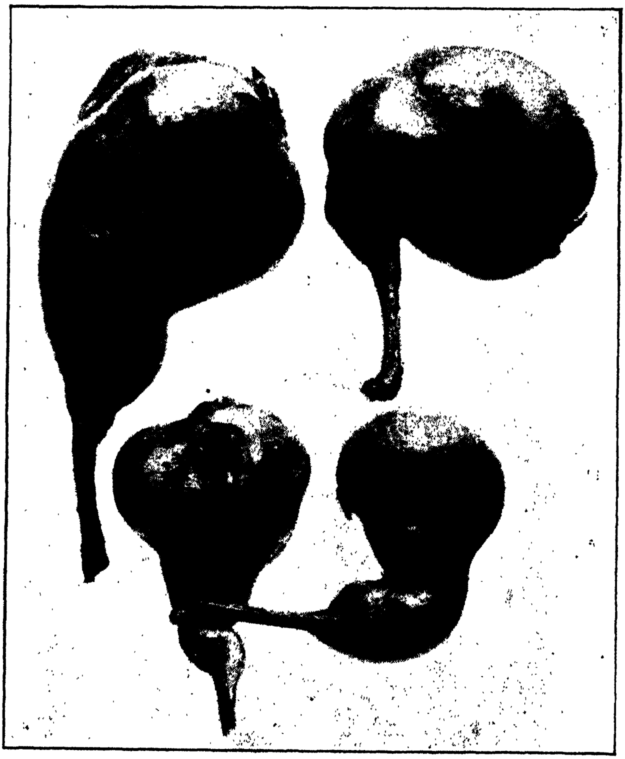
Until this issue the above Manual has appeared in our advertisement pages as being available from the Department at a cost of one shilling. Will our readers please note that the Manual is now out of print, and copies are not now obtainable from the Department of Agriculture. This notice is given in order to prevent the further forwarding of remittances in the expectation of being supplied, and thus avoiding disappointment.

PEAR SCAB

(*Venturia pyrina*).

GEO. W. WICKENS,
Superintendent of Horticulture.

Pear growers in Western Australia who shipped pears this year on consignment to Great Britain and the Continent of Europe will be pleased with the results obtained, for, in most instances, reports show that the fruit landed in sound condition and was sold at very satisfactory prices. Unlike the apple crop, the pear crop this year was below the average, and consequently



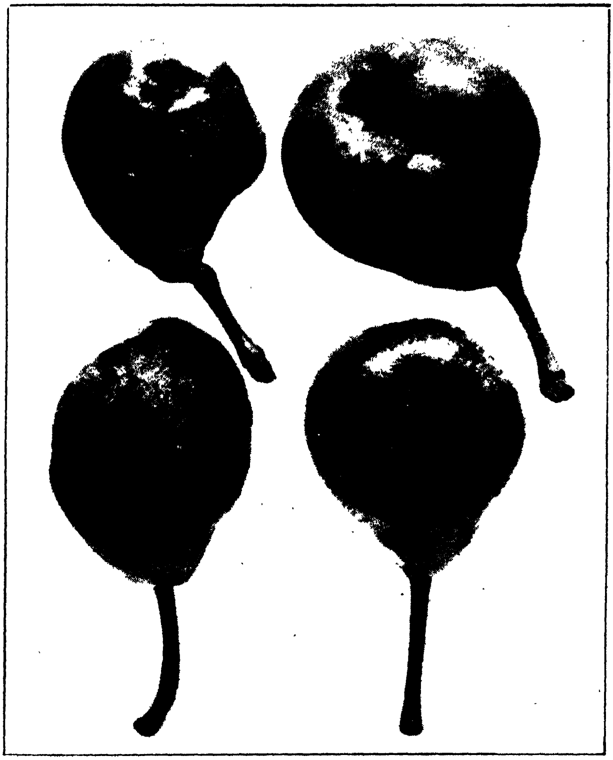
"Vicars" from unsprayed trees.

we may reasonably look forward next season to the crop being from good to heavy, and the profitable returns from the overseas markets, mentioned above, will lead to increased shipments.

To avoid disappointments and losses in connection with the expected good crop next season, it behoves all pear growers to take the necessary steps to guard against pear scab, and the experience which the Department has

had, both in the last and previous seasons, shows that when one thorough spraying is applied during the pinking stage of blooming, no appreciable loss from scab occurs, even though weather conditions during spring are favourable to the growth of the fungus.

Last year at Bridgetown Mr. Flintoff, the Orchard Supervisor, carried out a spraying test with a block of 55 trees comprising "Vicars," "Bartletts," and "Winter Nelis." Home-made Bordeaux Mixture was used at a strength of 6lbs. of bluestone and 6lbs. of best spraying lime, in 50 gallons of water. The spray was applied at pinking stage of blooming, that is, when the majority of the blossoms were showing pink, and control trees of each variety were left unsprayed. The sprayed trees produced nearly 100 per cent. of fruit free



"Winter Nelis" pears from unsprayed trees.

from scab, and the unsprayed trees produced nearly 100 per cent. of fruit so badly affected with scab as to be unmarketable. The accompanying photographs of fruit from the unsprayed trees are fair average specimens and serve to show that weather conditions were very favourable for the fungus.

When the spraying programme was outlined it was intended to spray half the trees in the block a second time, using lime sulphur at a strength of one gallon lime sulphur in 35 gallons of water after the fruit had set. When,

however, it was found that both fruit and leaves were practically free from the disease this idea was abandoned and only a few trees were sprayed to ascertain if lime sulphur at the strength named would have a burning effect on the leaves and fruit. The day selected was a cloudy one and temperatures were mild for 24 hours afterwards, but the spray seriously damaged the foliage and a big proportion of the crop fell off. It is known that when the fruit has set an application of lime sulphur at a strength even of 1 in 40 if the temperature at the time of spraying is over 75 deg. F. may cause burning of foliage and dropping fruit. It is also known that a second spraying with Bordeaux, applied after the fruit has set, will badly russet the fruit, so the absolute necessity of an effective pinking stage spray as described above is apparent.

To summarise—

(a) Pears exported this year from Western Australia to Europe and United Kingdom have, in the main, carried well and realised good prices.

(b) The pear crop of 1930 will probably be a heavy one and overseas markets will be needed to dispose of it.

(c) Pear Scab (*Venturia pyrina*) is a serious menace to the pear industry in Western Australia, as it is present in nearly every commercial pear orchard in the State.

(d) Pear Scab can be effectively controlled by thoroughly spraying with Bordeaux Mixture (6-6-50) at pinking stage of blooming.

(e) Should scab appear when fruit is set, lime sulphur at a strength not greater than one gallon of lime sulphur in 40 gallons of water can be used, but care must be exercised in choosing a time when the temperature is not more than 75 deg. F. and, if possible, when the weather is cloudy.

"THE JOURNAL OF AGRICULTURE"

will be supplied free *on application* to any person in the State who is following Agricultural, Horticultural, or Viticultural pursuits, to Agricultural Societies or Associations, and to any person otherwise interested in Agriculture.

A charge of Threepence per copy will be made for the *Journal* to per sons other than the foregoing, or who do not reside in the State. These applications accompanied by the requisite amount, must be forwarded to the Director of Agriculture, Department of Agriculture, who will also receive all correspondence dealing with the conduct of the *Journal*.

Editors of agricultural and country papers are invited to reproduce any of the articles contained in this *Journal*, providing the usual acknowledgment is made.

If you are not receiving the *Journal*, which is issued quarterly, and wish to do so, please forward your name and postal address to the Director of Agriculture, Perth.

BIOLOGICAL CONTROL OF THE SILVER-EYE.

(*Zosterops gouldi.*)

L. J. NEWMAN,
Entomologist.

Birds play a large part in the economy of nature. In relation to Agriculture, Fruit-Growing and Forestry, they are visible agents for good or for ill.

The feeling of man towards birds should, generally speaking, be a kindly one. The bulk of the birds are beneficial and, therefore, should be encouraged to take up their quarters in our fields and orchards.

That insectivorous birds are an important and efficient check upon insect multiplication is impossible of denial and it is doubtful if anywhere in the animal kingdom there is to be found a more important restraining influence. It is frequently found that man himself, by shooting, trapping, etc., is doing much to destroy that animal life which is of so much value to him.

The problem with which we are faced is how to cope with a bird like the one under discussion which is both beneficial and destructive—in other words it is both an insectivorous and fruit-eating bird.

The Silver-eyes are spoken of in very strong English by the majority of fruit-growers during the fruit season. Yet, if they are questioned regarding the feeding habits of these birds during the other nine months of the year, it will be found that many do not know of their insect-feeding capacity.

Silver-eyes undoubtedly cause considerable and, in some areas, very serious damage to soft fruits and grapes. The fruit-pecking habit of these birds is most disheartening. It is not so much what they eat as the amount of fruit they render unsaleable. Once a fruit is pecked it soon becomes invaded by the maggots of the ferment flies, by bees and other insects, and quickly ferments and rots. These birds move about in flocks, and consequently very quickly injure a large percentage of the fruit should they alight in an orchard containing soft fruits or grapes. A great proportion of the damage is done in the early morning hours just following sunrise.

Another objectionable feature is the eating of the fruits of noxious plants, such as the African Box Thorn and the Blackberries. They, by so doing, become potent disseminators of the seeds of these objectionable weeds.

That there are two sides to every question is a very true saying. Although it is admitted that the Silver-eyes are a great medium of loss during the soft fruit and grape season, the other side of the question must not be overlooked. During the season when fruit is not available, these birds apparently serve a definitely useful purpose in destroying many insects. This statement can be verified by taking observations of their feeding habits during winter and spring. These avians can be seen searching in a most thorough manner for aphides, scales, etc. They move from tree to tree chasing and capturing their insect prey.

Some years ago the question whether Silver-eyes should be placed on the Vermin List was discussed and dealt with by a specially appointed Board. The findings of the Board were definitely opposed to declaring these birds vermin.

To prove that Silver-eyes are insect feeders, a number were shot and the stomach contents investigated. The examination revealed the presence of scales, aphides, thrips, leaf hoppers, plant bugs, small caterpillars and various flies.

Having assessed the good and bad traits of these birds, it will be realised that it would be a fatal error to wage a war of extermination against them. No one person or thing in this world lives unto itself or gets its

Plate 1—Silver-eye (*Zosterops gouldi*).
(Photo. by Andrewartha—by kind permission of Curator of Museum, Perth, W.A.)

own way—neither the bird, the grower nor the grown; and it is a fact that, while all parties appear to demand individual rights, one from the soil, the other from the products of the garden, they are indispensable to each other in the working out of nature's great balancing plan. If it were possible to exterminate Silver-eyes we should very soon find that the balance of nature had been seriously disturbed, with the result that our last state would be worse than the first.

It is agreed that, during the fruit season, energetic measures should be adopted to keep the birds away from the fruit. To shoot or poison these birds away from the place of transgression is, in my opinion, little better than whipping a dog hours after it had committed the wrong.

The method of control which is being advocated in this article is a biological or natural one. It is common knowledge that the Butcher-bird (*Cracticus destructor*) is the natural enemy of small birds. Silver-eyes amongst others are captured by this predator and are dismembered and eaten.

Plate 2—Tyrant Butcher-bird (*Cracticus destructor*).
(Photo. by Andrewartha—by kind permission of Curator of Museum, Perth, W.A.)

The call or voice of this bird causes terror amongst smaller ones. The Butcher-birds are very pugnacious, and will attack other birds whether hungry or not. They are also insect feeders, beetles and grasshoppers forming their main insect diet. Knowing the vicious propensities of these birds against other small avians, it is proposed that they be reared and tamed in the orchard or vineyard.

During the past two fruit seasons a practical experiment of the effectiveness of the use of Butcher-birds in keeping the Silver-eyes from the orchard has been undertaken by Mr. C. Sporn, of Coolup. He claims to have solved the difficulty without having to kill a single bird valuable in its proper place.

Mr. Sporn writes as follows:—

"I reared a couple of these Butcher-birds, and about five months afterwards they proved their value. Very few small birds other than Wagtails dare to come within a quarter of a mile of my orchard or vineyard, and those that do are cleared out before they do any damage. I now get 98 per cent. of my Smyrna figs, all my grapes, soft Jap plums and prunes. I have now proved this for the past two years. Butcher-birds will attack any strange birds. When an occasional parrot comes along he is quickly driven about, and eventually clears out in disgust.

To rear Butcher-birds successfully, they must be fed on raw meat (no salt meat) all the year round. They have to be fed in the orchard several times a day. Once they know where to expect their food, there is no further trouble. The fresh meat should be cut up into small pieces and placed in a receptacle. The housewife or children can attend to the feeding of the birds.

"When taking young Butcher-birds from the nest, they will need to be kept warm at night time. This is best done by providing a coverlet made with an oatmeal bag lightly stuffed with soft feathers. The birds should be kept in a large and roomy cage made with one-inch mesh netting, the larger the better. When able to fly they should be encouraged to come back to their roosting place. The birds should not be handled or caught at any time, as, if they become too tame and confident, the cats will surely capture and destroy them.

"They must be provided with plenty of water in the summer time, and a suitable vessel containing water wherein they can bathe."

Mr. Sporn, who has proved the experiment with the Butcher-bird to be so successful, has outlined the methods of rearing and feeding.

The experiment is recommended as being worthy of a good trial by other orchardists. If successful, it will be inexpensive; if otherwise, it can be discontinued at any time.

MERREDIN AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1928-29.

Judge: G. L. THROSSELL, Dipl.Agric, Agricultural Adviser.

From a season like the past, perhaps the most important lesson we learnt was the value of good fallow for wheat growing. That the farmers of the Merredin and surrounding districts are keenly interested in the subject is clearly indicated by the excellent number of entries received for the Fifty-Acre Fallow Competition conducted by the Merredin Agricultural Society, for which there were no less than twenty-three competitiors. With such a large number of entries, it is not surprising that, scattered as they were over the whole district, there was marked variation both in soil types and rainfall.

The points under which the Competition was judged were as follow:—

Moisture	40	points
Condition of mulch	10	„
Absence of weeds	10	„
Consolidation	20	„
Uniformity of preparation	20	„
Total	100	„

Although the schedule specified that judging should take place in January, it was not possible to commence until 26th February. This was unfortunate on account of heavy rains which fell on 16th February, and this precipitation was not uniform throughout the district. Thus it was not possible to distinguish between moisture already conserved in the fallow and that caught in the last rain, for the two had "connected." This rain, too, was an advantage to some competitors in the respect that it afforded them an opportunity of correcting defects present, which would have been detected by earlier judging.

The following table shows the rainfall recorded at centres nearest to the competitors from June until February, inclusive:—

Centre.	Fallowing rains.				Spring rains.			Summer rains.					Total June to Feb.
	June.	July.	Aug.	Total.	Sep.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Merredin Ex. Farm	107	224	154	485	71	19	90	...	24	50	162	236	811
Burracoppin	116	272	175	563	81	28	109	...	35	5	181	221	893
East Goomarin	83	182	163	328	79	18	97	12	35	18	142	207	632
Korbel ...	88	277	242	607	90	23	113	...	55	46	118	219	939
Nukarni ...	78	202	191	471	56	28	84	4	46	10	173	233	788

The winning fallow was that of Mr. T. H. Smallacombe of Nangeenan, who scored 93 points. The land originally carried salmon gum, gimlet and mallee. It was ploughed with a Sundercut in June to a depth of four inches and received two cultivations, both with a combine, the first towards the end of August, the other in September. This entry showed that care had been taken in all cultural operations, resulting in a very uniform piece of fallow.

Messrs. Robartson Bros., also of Nangeenan, were placed second, with an entry which gained 92 points. The moisture content of this entry was as good as the winning fallow, and both were ahead, in this respect, of any of the other competitors.

The following table summarises the cultural methods, and shows the points awarded to each competitor:—

MERREDIN AGRICULTURAL SOCIETY.

FALLOW COMPETITION—1928-29.

Competitor and District.	Original Timber.	Rotation.	Time of Fallowing.	Type of Plough.	Depth of Ploughing.	Condition of Land at time of Ploughing.
1—T. H. Smallacombe, Nangeenan	Salmon Gum, Gimlet and Mallee	2 years	Late June	Sundercut	4ins.	Good
2—Robartson Bros., Nangeenan	Mallee, Scrub, Salmon, White Gum, and Gimlet	2 years	Late June	Sundercut	4ins.	Good
3—W. Cook, South Walgoolan	Salmon Gum and Gimlet	2 years	Early July	Sundercut	3ins.	Good
4—F. W. Reichelt, Nth. Burracoppin	Salmon Gum, Gimlet, Mallee and Scrub	2 years	June-July	Mouldboard	3-4ins.	Fairly dry
5—F. W. Reichelt, Nth. Burracoppin	Salmon Gum, Gimlet and Jam	2 years	Mid May	Combine drill	2½ins.	Dry
6—C. H. Rowan, Korbel	Salmon Gum, Gimlet, Mallee, Jam, Scrub	3 years	Late June	Mouldboard	3-4ins	Hard
7—W. H. Cockram, Nukarni	Salmon Gum, Gimlet, Tea Tree, Jam	2 years	Mid June	Disc	3½-4in.	Good
8—J. D. Maughan, Sth. Walgoolan	Gimlet, Tea Tree, Mallee	2 years	Early June	Disc (cultg.)	3-4ins.	Good
9—T. Maughan, South Walgoolan	Salmon Gum, Gimlet	2 years	Early July	Sundercut	3ins.	Good
10—R. T. Mussared, Belka	Salmon Gum and Gimlet	2 years	June-July	Skim Mouldboard	3½ins.	Good
11—J. J. S. Cuming, Korbel	Salmon Gum and Gimlet	3 years	Early Jan	Scarifier	3ins.	Fairly hard
12—E. C. Biggers, Goomarin	Salmon Gum and Gimlet	2 years	July	Disc	4ins.	Good
13—A. Zwar, Nangeenan	Salmon Gum, Gimlet, Mallee, Tea Tree	2 years	July	Sundercut	4ins.	Wet
14—L. J. Meiklejohn, Goomarin	Salmon Gum, Gimlet, Jam	2 years	June	Disc	3-4ins.	Good
15—W. S. Currie, North Burracoppin	Salmon, Gimlet, Boree	2 years	Early June	Sundercut	3ins.	Good
16—R. R. Bate, North Burracoppin	Salmon Gum, Gimlet, Tea Tree	2 years	June	Cultiv. Disc	4ins.	Good
17—R. Woodhouse, East Goomarin	Salmon Gum, Gimlet and Mallee	2 years	Mid July	Sundercut	3½ins.	Good
18—G. Day, East Goomarin	Red Morrell, Gimlet	2 years	June-July	Mouldboard	3ins.	Fair
19—E. C. Parsons, East Goomarin	Morrell and Salmon Gum	2 years	July	Sundercut	3-4ins.	Fair
20—A. S. & F. Higgins, Goomarin	Morrell and Salmon Gum	2 years	July	Sundercut	3-4ins.	Good
21—L. Hawke, Nokanning	Morrell, Salmon and Gimlet	2 years	...	...	...	...
22—E. Randolph, East Goomarin	Salmon Gum, Gimlet	2 years	July	Disc	3½ins.	Fairly good
23—Woodward Bros., Goomarin	Morrell, Salmon Gum, Gimlet	2 years	Early July	Disc	3½-4in.	Good

MERREDIN AGRICULTURAL SOCIETY—*continued.*

FALLOW COMPETITION—1928-29—*continued.*

Competitor and District.	Cultivations.	Points. Moisture. 40	Mulch. 10	Absence of Weeds. 10	Consolidation. 20	Uniformity of Preparation. 20	Total. 100
1—T. H. Smallacombe, Nangeenan	Combined end of August and end of September	38	8	9	19	19	93
2—Robertson Bros., Nangeenan	Cross sundercut end July. Springtyned end August, and harrowed in February	38	9	8	18	19	92
3—W. Cook, South Walgoolan	Scarified in August and September. Springtyned in January and February	35	9	9	19	19	91
4—F. W. Reichelt, Nth. Burracoppin	Harrowed after rain mid July., scarified beginning August. Harrowed end August. Harrowed (dry) in September. Combined in February	35	9	9	19	19	91
5—F. W. Reichelt, Nth. Burracoppin	Combined 3ins first week June and in July. Scarified end August. Harrowed in September. Combined in February	34	9	9	19	19	90
6—C. H. Rowan, Korbel	Scarified and harrowed end August. Harrowed in September. Springtyned in February	35	8	9	19	19	90
7—W. H. Cockram, Nukarni	Springtyned beginning July. Sundercut end August. Springtyned in February	37	8	8	18	19	90
8—J. D Maughan, South Walgoolan	Reploughed in July and end August. Combined in January	36	8	8	19	18	89
9—T. Maughan, South Walgoolan	Scarified in August and September. Springtyned in January and February	35	8	8	19	19	89
10—R. T. Mussared, Belka	Springtyned twice in August. Harrowed September. Springtyned October. Harrowed in February	36	8	7	19	19	89
11—J. J. S. Cuming, Korbel	Scarified mid. August. Springtyned and harrowed end August. Scarified in September	34	8	9	19	18	88
12—E. C. Biggers, Goomarin	Sundercut Aug. Springtyned (dry) November. Harrowed January, and twice February	34	8	9	19	18	88
13—A. Zwar, Nangeenan	Sundercut September. Harrowed February	36	7	8	18	17	86
14—L. J. Meiklejohn, Goomarin	Combined twice in Aug.	33	8	8	18	18	85
15—W. S. Currie, North Burracoppin	Sundercut July. Combined in August. Harrowed September and February	32	7	8	18	19	84
16—R. R. Bate, North Burracoppin	Reploughed August. Springtyned and harrowed September. Harrowed February	32	8	7	18	18	83
17—R. Woodhouse East Goomarin	Sundercut end August. Springtyned September. Portion harrowed February	32	7	8	18	18	83
18—C. Day, East Goomarin	Springtyned August. Harrowed February	32	7	9	18	17	83
19—E. C. Parsons, East Goomarin	Combined August. Harrowed September. Springtyned February	32	7	7	18	19	83
20—A. S. & F. Higgins, Goomarin	Sundercut September. Harrowed February	31	8	7	18	18	82
21—L. Hawke, Nokanning	... ...	32	7	7	18	17	81
22—E. Randolph, East Goomarin	Sundercut September. Springtyned February	30	7	7	19	17	80
23—Woodward Bros, Goomarin	Combined August. Reploughed October Springtyned February	30	7	7	18	17	80

A little study of the above table yields some interesting information as to the competitors' methods.

Information could not be obtained from one competitor who was absent at the time of judging. Of the remaining 22 competitors, one fallowed in May, 12 in June, and 9 in July. Experiments at the Merredin Experiment Farm have definitely proved that early fallowing in June is better than late August fallowing, and it is pleasing to note that the farmers in this district are being guided by these results.

No less than sixteen competitors used disc implements for the initial fallowing operation, and of these nine were sundercuts. The mouldboard plough was used by four, while the combine and scarifier were used by one each. The type of plough used depends chiefly upon the nature of the soil and the available capital. The sundercut is favoured on account of its utility both as a plough and a cultivator. The most important point to be observed is, that whatever type of implement is employed, to be certain that it is doing the work thoroughly. This was a section under which several competitors lost points, and it was obvious after an inspection of the fallow that the initial ploughing had not been performed thoroughly. In some cases the ploughs had not been correctly set, leaving the fallow full of ridges and hollows. In others there were too many hard patches or unploughed portions, particularly along the headlands and corners.

The depth of ploughing varied between three and four inches. Experiments conducted at the Experiment Farm show that on salmon and gimlet country the minimum depth should be four inches, although no definite information is available. It is believed, however, that on the morrell types of soil the consolidation of the seed bed is less difficult to secure when the land is not ploughed so deeply, and it is considered also that the less disc implements are used on this class of country the better.

The average number of workings which the fallows received was three. Nineteen entries received their first cultivation before the end of August, and of these one was cultivated in June and five in July. Three only left their first cultivation as late as September. For this operation implements of either the spring or rigid tyne type are recommended. These implements comb the clods to the surface, allowing the finer particles to fall to the bottom, producing a firm seed bed, while the disc implements have a tendency to bury the clods and leave the seed bed too open. Other factors such as the presence of weeds, however, may necessitate the use of a disc cultivator, but it is advisable that the subsequent operation should be with a tyned implement.

It is pleasing to note that the use of harrows is becoming more general for maintaining the mulch after summer rains. The danger of working the fallow when dry is also appreciated.

It is surprising to find that of the twenty-three competitors only two are employing a three-year rotation, all the others being fallow and crop. It is expected that from the point of view of disease control a three-year rotation will shortly become more general.

Sheep were run on five fallows only. This accounts, no doubt, for the fact that several entries were rather weedy.

It is to be hoped that this competition will not only benefit the individual competitors themselves, but that by the feeling of healthy rivalry which it creates will also raise the standard in the district of firstly the fallow, and consequently the district yield.

WONGAN HILLS AGRICULTURAL SOCIETY.

FALLOW COMPETITION.

Judge: R. P. ROBERTS, B.Sc.(Agric.), Agricultural Adviser.

The number of entries in this Competition was extremely disappointing, there being only two competitors—Mr. J. H. Ackland and Mr. R. B. Ackland. Mr. J. H. Ackland submitted two entries for inspection, one being on light country and the other on heavy forest country. Mr. R. B. Ackland's entry was on heavy forest country. The points alloted are as hereunder:—

Competitor.	Moisture.	Consolidation.	Mulch.	Absence of weeds	Uniformity of Preparation.	Total.
	40	20	10	10	20	100
Ackland, J. H.	39	18	9	10	19	95
Ackland, R. B.	37	18	8	10	17	90
Ackland, J. H.	35	16	6	9	16	82

The area submitted for inspection by Mr. J. H. Ackland on light land was awarded first place. The country originally carried tamma thicket and wattle. The land was ploughed during June, 1928, to a depth of 3½ to 4 inches. It was harrowed during September and cultivated with a sprintyne implement in October. Immediately following a fall of nearly three inches of rain in February the area was harrowed, and it had been cultivated with a springtyne cultivator the day prior to inspection in March. The mulch was a little too fine—a defect which it is difficult to avoid in this class of soil. The moisture content was excellent, and weed growth was totally absent.

Mr. R. B. Acklands entry was on heavy forest country, which originally carried morrell timber with a little york gum and yorrell. The land was ploughed from the middle of June to the beginning of July with a four-furrow mouldboard plough to a depth of 3½ inches. It was cultivated during August with a springtyne implement and harrowed during September, and again after heavy rain in December. It was again springtyne cultivated in February after 274 points of rain.

The moisture content was good owing to prompt cultivation after the heavy rain in February. A slight depression extending across the competition area had led to the formation of several small hard patches, and in a few places where the ground had evidently been too wet when ploughed, large hard clods were in evidence. On the whole, however, the exhibit was distinctly good.

Mr. J. H. Ackland's entry on forest country was ploughed during June with a six-furrow mouldboard plough to a depth of 3½ to 4 inches. It was harrowed during September, cultivated with a springtyne implement in October, and part was harrowed and the remainder cultivated after heavy rain in February. This entry was somewhat marred by a strip which had been treated in a slightly different manner from the rest. The harrows had been

used on this portion in February, but evidently not until some little time had elapsed after the rain. The result was that the implement did little more than scratch the surface, the sub-surface remaining hard and lumpy. A springtyne implement was used on the remainder of the area, and little fault was to be found with the mulch and seed bed. The area was free from weeds, save for an occasional sucker which detracted slightly from the general appearance of the fallow.

CORRIGIN AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1928-29.

Judge: G. L. THROSSELL, Dipl.Agric., Agricultural Adviser.

Six entries were received for the Fallow Competition conducted by the Corrigin Agricultural Society.

The scale of points upon which the judging was based was as follows:—

Moisture	40	points
Condition of mulch	10	,,
Freedom from weeds	10	,,
Consolidation	20	,,
Uniformity of preparation ..	20	,,
Total ..	100	,,

The rainfall recorded at Corrigin from June until February is shown hereunder:—

—	Fallowing rains.				Spring rains.			Summer rains.					Total June to Feb.
	June.	July.	Aug.	Total.	Sep.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Corrigin ...	85	434	279	798	125	66	191	9	48	28	24	109	1.098

The Competition was won by Messrs. J. R. Bremner & Sons with an entry which scored 90 points. This particular piece of fallow, which was only a portion of a large paddock similarly worked, was causing a good deal of interest locally, by reason of the departure from the usual method of winter fallowing. The original timber on this land was a mixture of jam, york and salmon gum, gimlet and mallee. It was scarified to a depth of three inches in March, 1928, after a stubble burn, and received four workings—a springtyne cultivation in June and July, harrowed in August, and scarified and harrowed in September. This was a very uniform piece of

fallow, a mulch of desirable tilth and depth overlying a level and well-consolidated seed bed. It was free of weeds, but the moisture content was not as high as that of the entry which came second.

Mr. G. W. Rendell was placed second with 89 points. His entry was July-fallowed scrub plain, which had been ploughed to a depth of four inches with a mouldboard, and which had been cultivated with a sundercut in September and a springtyne in November. This entry had the highest moisture content in the Competition, the mulch, however, was a little deep.

The following table shows the cultural methods of the competitors and the points awarded:—

CORRIGIN AGRICULTURAL SOCIETY.

FALLOW COMPETITON—1928-29.

Competitor.	Original Timber.	Rotation.	Time of Fallowing.	Type of Plough.	Depth of Ploughing.	Condition of land at time of ploughing.
1—Bremner, J. R. & Sons	Jam, York and Salmon Gum, Gimlet and Mallee	2 years	March	Scarifier ...	3ins.	Dry
2—Rendell, G. W.	Scrub plain ...	3 yrs.	July	Mouldboard ...	4ins.	Good
3—Jenkins, R. M.	Gimlet and Morrell	2 yrs.	End June, beginning July	Mouldboard ...	4½ins.	Good
4—McAndrew. R.	Salmon Gum, Gimlet, Jam, White Gum and Mallee	2 yrs.	Early June ...	Mouldboard ...	4ins.	Good
5—Cronin, J.	Gimlet and Jam ...	2 yrs.	Early July ...	Scarifier ...	3ins.	Good
6—Ding, J. B.	Scrub plain ...	Virgin land	Early Sept. ...	Disc	5—6ins.	Fairly dry

Competitor.	Cultivations.	Points.					
		Moisture.	Mulch.	Absence of Weeds.	Consolidation.	Uniformity of Preparation.	Total.
		40	10	10	20	20	100
1—Bremner, J. R. & Sons	Springtyned in June and July. Harrowed in August. Scarified and harrowed in September	33	9	10	19	19	90
2—Rendell, G. W.	Sundercut in September. Springtyned in November	35	8	9	18	19	89
3—Jenkins, R. M.	Scarified in August and early in October	32	9	8	19	19	87
4—McAndrew, R.	Springtyned in September and October	34	8	8	18	18	86
5—Cronin, J.	Crossed with scarifier in July. Springtyned twice in August and a portion again in September	34	8	7	19	18	86
6—Ding, J. B.	Harrowed in November	30	7	8	16	17	78

MT. MARSHALL AGRICULTURAL SOCIETY.

FALLOW COMPETITION 1928/29.

Judge: G. L. THROSSELL, Dipl. Agric.
Agricultural Adviser.

Eight entries were received for the fallow competition conducted by the Mt. Marshall Agricultural Society, Bencubbin. Judging was commenced on February 14th, but was not completed before rain commenced on 15th. However all those competitors adjacent to Bencubbin were judged before the rain had influenced the fallows, but owing to difficulties of transport, 175 points had been recorded at Yelbeni before inspection there. This of course benefited the moisture content of that entry and had an adverse effect upon the tilth of the mulch.

The rainfall recorded at official stations nearest to the competitors from June to February was as hereunder:—

—	Fallowing rains.				Spring rains.			Summer rains.					Total.
	June	July.	Aug.	Total.	Sep.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Bencubbin ...	53	231	148	432	66	32	98	2	51	17	84	154	684
Trayning ...	75	256	233	564	97	10	107	...	35	4	201	240	911

The scale of points upon which the judging was based is as follows:—

Moisture	40 points
Condition of Mulch	10 "
Freedom from Weeds	10 "
Consolidation	20 "
Uniformity of Preparation	20 "
	100

The competition was won by Mr. B. W. G. Hopwood whose fallow scored 89 points. The land which originally carried Mallee and Tea-tree had been ploughed to a depth of 4 inches with a disc implement (Sundercut), in July and had been springtyne cultivated in September. On account of the absence of rains of any consequence during the summer months, as the table indicates, the fallow received no further cultivations prior to judging.

The fallow which gained second place was that of Hr. G. Dunkley of Yelbeni. As explained previously this fallow had an additional 175 points of rain before it was judged, and after those in the Bencubbin area had been completed. It is not surprising therefore, that it gained the highest points for moisture content, though the condition and tilth of mulch suffered in consequence. This entry was July fallowed. the initial operation being performed with a sundercut, followed by two cultivations in October and December.

The points awarded and cultural methods are set out in the following table:—

MT. MARSHALL AGRICULTURAL SOCIETY (BENCUBBIN.)

FALLOW COMPETITION, 1928–29.

Competitor and District.	Original Timber.	Fallowing Period.	Type of Plough.	Depth of Ploughing.	Condition of land at time of fallowing.
1.—B. W. G. Hopwood, Bencubbin	Mallee and Tea-tree	July	Sundercut	4ins.	Good
2.—G. A. Dunkley, Yelbeni	Gimlet, Tea-tree, Mallee	July	Sundercut	3ins.	Good
3.—E. C. Collins, Bencubbin	Salmon, Gimlet, Jam and Mallee	June	Sundercut	3–4ins.	Good
4.—M. Collins, Bencubbin	Gimlet	July	Mouldboard	4ins.	Good
5.—W. Gobbart & Sons, Gabbin	Salmon and Gimlet	June	Sundercut	3—4ins.	Good
6.—H. Beagley, Bencubbin	Mallee, Jam and Gimlet.	August	Sundercut	3ins.	Good
7.—McManus Bros. (1) North Bencubbin	Scrub	Feb., 1927	Sundercut	6ins.	Dry
8.—McManus Bros. (2), North Bencubbin	Scrub	June	Sundercut	5ins.	Good

Competitor and District.	Cultivations.	Points.					
		Moisture. 40.	Condition of Mulch. 10.	Freedom from weeds. 10.	Consolidation. 20.	Uniformity of Preparation. 20.	Total. 100.
1.—B. W. G. Hopwood, Bencubbin	Springtyned in September	33	9	9	19	19	89
2.—G. A. Dunkley, Yelbeni	Cultivated in October and December	36	8	8	19	17	88
3.—E. C. Collins, Bencubbin	Sundercut in July. Springtyned September	32	9	8	19	18	86
4.—M. Collins, Bencubbin	Tandem disced in January	32	8	8	19	18	85
5.—W. Gobbart & Sons, Gabbin	Springtyned September and November	32	9	7	18	18	84
6.—H. Beagley, Bencubbin	Portion sundercut, balance tandem disced in October	32	7	7	19	18	83
7.—McManus Bros. (1), North Bencubbin	Sundercut June, 1928. Tandem disced and harrowed October	30	7	6*	17	16	75
8.—McManus Bros. (2), North Bencubbin	No cultivations ...	28	6	7*	16	16	73

*Points were lost under this section for a large re-growth of suckers and scrub, etc.

The standard workings recommended for the preparation of the seed bed are:—

June, July, August.—Plough thoroughly.

September.—Cultivate with a springtyne cultivator or if weedy, skim plough.

October.—Cultivate and leave ground clean and crumbly, not too fine.

November to April.—Cultivate with springtyne or harrows after heavy rain to maintain mulch and destroy weeds.

May.—Sow seed after cultivation.

Experiments conducted at the Merredin Experiment Farm have demonstrated that considerable benefit is derived from early fallowing. The average results from early June fallow over a period of five years, are 4

bus. 26 lbs. per acre more than from late August fallow. Therefore, every farmer should endeavour to get as much of his fallowing as possible, done during the early portion of the fallowing period. In this respect, it is considered better and safer to commence fallowing early in June, rather than to prolong seeding, as experiments have definitely shown. It is important, also, to carry out the initial operation of ploughing in a thorough manner and in this regard it will be noticed that several competitors lost points. The type or make of plough used, is not as important as seeing that it is doing its work thoroughly.

When fallowing, such details as ploughing out the corners and headlands must be taken into consideration—a point which tractor farmers are sometimes inclined to overlook. A fallow with the roots and stumps in evidence is akin to submitting an ungroomed horse for judging in the show ring: this however, is perhaps the least important item.

As regards the first cultivation after ploughing, such factors as weed growth and tilth would influence what implement to use. If very weedy, it may be necessary to skim plough or turn back the fallow, but if not very bad, a springtyne cultivator or scarifier, with wide points would be suitable. Sheep are really essential for successful wheat farming, particularly in assisting to control weed growth. They also aid consolidation and return nutriment in their droppings, thereby maintaining the fertility of the soil. Only three of the competitors were sheep-owners, accounting somewhat for a fair amount of weed growth being in evidence upon the fallows inspected.

It is important that the spring cultivation should not be delayed any longer than necessary, for it is this operation which makes the mulch which should retain the moisture caught in the fallow during the winter. This cultivation which should be done with either a springtyne or scarifier, should be to the full depth of ploughing, for by so doing, the clods in the seed bed are combed to the surface—the finer particles fall to the bottom and a better consolidation is obtained. A disc implement has a tendency to bury the clods and also makes the mulch too fine. Should it not be possible to get over all the fallow with the springtyne cultivator or scarifier, a heavy set of harrows could be utilised to advantage, rather than leaving the ploughed land untouched. Subsequent cultivations should be shallower than the first, aiding consolidation, and preventing loss of moisture.

After heavy summer rains, the harrows will be found, under ordinary circumstances, to be satisfactory because firstly, they enable a large area to be covered in time to retain the moisture before it evaporates, and secondly, they aid consolidation. Care must be taken however, to ensure that the tilth does not become too fine. This is likely to occur should the harrows be used too frequently.

Experiments have proved that under conditions prevailing in our wheat belt, it is not necessary, moreover it is not profitable, to cultivate in the summer except after heavy rain. The practice of cultivating when the mulch is dry is harmful because it makes the mulch too fine and impairs consolidation, and the indications are that it aids the spread of the disease "Take-all."

In conclusion, I would like to appeal to the farmers of the Mt. Marshall district to take an active interest in the Fallow Competitions. It has been suggested that next year, the competitors and any farmers interested should accompany the judge on his tour of inspection. They could then see for themselves the good and bad points of each entry, and no doubt gain thereby useful information which they could apply themselves next season.

BRUCE ROCK AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1928/29.

Judge—G. L. Throssell, Dip. Agric., Agricultural Adviser.

Eleven entries were received for the Fifty Acre Fallow Competition conducted by the Bruce Rock Agricultural Society, and ten were submitted for inspection—the same number as in the previous year.

Judging took place between 7th March and 9th March inclusive and in this case was not affected by February rains which were very much lighter than recorded in other areas. The rainfall recorded from June until the end of February was as follows—

	Fallowing Rains.				Spring Rains.			Summer Rains.					Total. June-February
	June.	July.	Aug.	Total.	Sep.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Bruce Rock	79	299	173	551	83	12	95	...	45	...	55	100	746
Central Kumminin	78	368	127	573	81	22	103	...	9	11	44	64	740

It is noticeable how, after September, which was below the average, the rainfall fell off and that the district experienced another dry summer.

The same scale of points as adopted in previous years was again used this year, viz.:—

Moisture	40 points
Condition of Mulch	10 „
Freedom from Weeds	10 „
Consolidation	20 „
Uniformity of Preparation ..	20 „
Total	100 „

The Competition resulted in Messrs. C. E. & N. S. Schilling and E. A. Ellis tying for first place, each scoring 91 points. Neither of these competitors has previously competed in this Society's Fallow Competition and they are to be congratulated upon carrying off the honours.

Messrs. Schilling's entry was early June fallow which had been ploughed to a depth of 3-4 inches with a disc implement (Sundercut). This fallow received four workings, three in the winter months, subsequent to ploughing and one in the spring. The first was a harrowing in June. The land was then scarified early in June and springtyne cultivated towards the end of the same month and again in September. This exhibit was very uniform. It was not quite as high in moisture content as that of Mr. Ellis but the mulch was very even, overlying a level well consolidated seed bed. The mulch, if anything, was a little on the fine side as regards tilth. There were very few weeds present.

The other winning exhibit, that of Mr. E. A. Ellis of Central Kumminin, was also an early June fallow, the initial operation being carried out with a disc implement (Sundercut) to a depth of 3 inches. This was followed by three cultivations—a harrowing in July, a disc cultivation (Sundercut) towards the end of July and springtyne cultivation early in

August. There was a slight crust on the surface of the mulch, a fault which could have been remedied by a harrowing. In other respects this fallow was equal to the other winning entry and in fact, as previously mentioned, was higher in moisture content.

The following table shows the cultural details and points awarded to the competitors—

BRUCE ROCK AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1928-29.

Competitor and District.	Original Timber.	Rotation.	Time of Fallowing.	Type of Plough.	Depth of Ploughing.	Condition of land at time of Fallowing.
		years.			inches.	
1.—C. E. & N. S. Schilling, Bungulluping	Salmon and Gimlet	3	Early June	Sundercut	3—4	Good
2.—E. A. Ellis, Central Kumminin	Salmon, Gimlet, Jam	2	Early June	Sundercut	3	Good
3.—Buller and Black, Babakin	Salmon, Gimlet, Morrell	2	Late June	Sundercut	3	Good
4.—R. Mann, South Shackleton	Gimlet, Tea-tree	3	Late July-August	Mouldboard	3—4	Good
5.—P. McCarthy and Son, Eujinya	Gimlet	2	Early June	Disc	4½	Good
6.—F. C. Farrall and Sons, Yarding	Salmon Gum, Mallee, Jam, Gimlet	3	Late June	Disc	3—4	becoming hard
7.—S. A. Brown, Bungulluping	Salmon, Gimlet	2	July	Scarifier	3—4	Good
8.—E. M. K. and C. Allen, Central Kumminin	Salmon, Gimlet	2	June	Scarifier	3	Good
9.—W. D. Johnson, Bruce Rock	Salmon, Gimlet	2	July-August	Mouldboard	4	Good
10.—G. E. Robins & Co., Babakin	Salmon, Gimlet, Morrell	2	End Jan.	Disc	4	Dry

Competitor and District.	Cultivations.	POINTS.					
		Moisture. 40.	Mulch. 10.	Absence of weeds. 10.	Consolidation. 20.	Uniformity of preparation. 20.	Total. 100.
1.—C. E. & N. S. Schilling, Bungulluping	Harrowed June, scarified early July. Springtyned end July and September	35	9	9	19	19	91
2.—E. A. Ellis, Central Kumminin	Harrowed July. Sundercut end July. Combined early August	36	8	9	19	19	91
3.—Buller and Black, Babakin	Springtyned August. Portion scarified end Septemper. Balance springtyned	34	8	8	19	19	88
4.—R. Mann, South Shackleton	Springtyned September. Scarified and harrowed early October	35	7	8	19	18	87
5.—P. McCarthy & Son, Eujinya	Sundercut early August. Springtyned early October and February	34	7	8	19	19	87
6.—F. C. Farrall & Sons, Yarding	Springtyned late July. Sundercut September. Harrowed January.	34	7	9	19	17	86
7.—S. A. Brown, Bungulluping	Scarified September. Springtyned October	33	8	9	18	18	86
8.—E. M. K. and C. Allen, Central Kumminin	Scarified August. Combined September.	34	7	8	19	18	86
9.—W. J. Johnson, Bruce Rock	Springtyned August-September	33	7	9	18	18	85
10.—G. E. Robins & Co., Babakin	Scarified mid. July. Harrowed August. Springtyned September. Harrowed October	32	8	6	18	19	83

An improvement was noticed this year as regards the time of fallowing. This year six competitors fallowed in June and three in July as against two in June last year and six in July. One competitior fallowed dry in January using a disc plough. It is to be hoped that a similar improvement will be evident next year, by which time perhaps all the fallows in the competition will be June fallows. "June fallow means better fallow; Better fallow means bigger yields" as indicated by experiments carried out in this direction at the Merredin Experiment Farm.

The sundercut (a disc implement) is still the most popular implement, although scarifiers are proving themselves very suitable machines for working the fallows.

It was noticed that discs are being used on Morrell land or land which originally carried an admixture of Morrell. This is not recommended on account of the difficulty of controlling the depth. Much harm can be done to Morrell land, particularly in the early stages, by working it too deeply and it sometimes takes years to remedy. It is not at all advisable to work Morrell land dry.

One of the chief faults with the fallows in this year's competition was the lack of uniformity of preparation. There were too many hard patches in evidence.

Mustard and barley grass were also fairly prominent on some fallows. The latter is a particularly bad weed as it harbours "Take-all." Sheep will eat it in the early stages when the weed is young.

SEED TESTING BY THE DEPARTMENT OF AGRICULTURE.

The Seed Testing Laboratory of the Department of Agriculture is prepared, as far as facilities will permit, to receive seeds for the purpose of making tests for both germination and purity (which includes the determining of the percentage of pure seed, and of weed seeds, including dodder). Samples should not be less than 2oz. in weight and should be addressed to the Plant Pathologist, Department of Agriculture, Perth. All particulars should accompany same, such as name and address of seller, and of sender; also year and place of growth and price paid. The charges for testing samples are—

(1) Complete test—6s.
(2) Purity only—4s. 6d.
(3) Germination—2s. 6d.

NUNGARIN AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1928/29.

Judge: G. L. THROSSELL, Dipl.Agric., Agricultural Adviser.

For the Fallow Competition conducted by the Nungarin Agricultural Society seventeen entries were received, and of these fourteen were submitted for inspection, one less than last year. Of these there were three competitors who had not previously entered for the competition. The district was well represented in regard, not only to the distribution of the competitors and the class of land, but also in respect to the high standard of fallow. The judging was based on the same scale of points as in previous competitions, namely:—

Moisture	40	points
Condition of mulch	10	„
Freedom from weeds	10	„
Consolidation	20	„
Uniformity of preparation ..	20	„
Total ..	100	„

The competition was judged between 19th and 22nd February, which was rather soon after a fairly general rain on 15th and 16th February. Under the circumstances, however, it was not possible further to delay judging. Some of the competitors (five) had not taken advantage of this rain to give the fallow a further cultivation. Four competitors situated in the Mukinbudin and Lake Brown districts, however, did not receive sufficient rain to warrant another cultivation, and in consequence were at a disadvantage as far as moisture content was concerned.

The rainfall recorded at official stations nearest to the competitors was as follows:—

——	Fallowing rains.				Spring rains.			Summer rains.					Total Rainfall, June to Feb. 19th.
	June	July	Aug.	Total.	Sep.	Oct.	Total.	Nov.	Dec.	Jan.	Feb.	Total.	
Nungarin ...	78	223	185	486	59	4	63	1	43	4	144	192	741
Talgomine ...	53	217	139	409	49	19	68	3	12	14	125	154	631

From the foregoing table it will be seen that after August no rains of any consequence fell until the week prior to judging—the registrations in September being chiefly in the nature of light showers spread over several days. It is therefore pleasing to note that nearly all the competitors cultivated their fallows almost immediately after ploughing and again early in

the spring, forming thereby an effective mulch, which, in the absence of summer rains, meant it was unnecessary to cultivate the fallows when dry. Thus it can be seen that a high standard of farming practice has been reached in this district.

The competition was won by Mr. G. T. Young, of Talgomine, whose entry gained 92 points. This fallow was salmon and gimlet country, which had been ploughed early in June with a mouldboard plough to a depth of 4 inches, and had received four cultivations. It was disced (sundercut) in August, scarified (with harrows behind) in September, in which month it was also springtyne cultivated (with harrows behind), and received a final harrowing after the mid-February rains. This fallow was indeed a credit to the competitor, and after inspection it was evident that all operations had been thoroughly performed. The mulch was in good tilth, and the seed bed level, but the consolidation might have been better.

Mr. F. A. Williams, of Mangowine, with a late June fallow gained second place, scoring 91 points. This entry was of particular interest, because the only implements used were a scarifier and a set of harrows. The land was scarified to a depth of three inches late in June. Harrows were attached behind this implement. The fallow received another scarifying in August, but received no further cultivation. The mulch, consolidation and thoroughness of preparation were good, but a few weeds, chiefly Potato Weed, were in evidence.

The following table summarises the cultural methods, and shows the points awarded to the competitors:—

NUNGARIN AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1928-29.

Competitor and District.	Original Timber.	Rotation.	Time of Fallowing.	Type of Plough.	Depth of Ploughing.	Condition of land at time of ploughing.
1.—G. T. Young, Talgomine	Salmon Gum, Gimlet	2 years	Early June	Mouldboard	4ins.	Good
2.—F. A. Williams, Mangowine	Salmon Gum and Gimlet	2 years	Late June	Scarifier	3ins.	Good
3.—J. H. Johnson, Mangowine	Salmon Gum and Gimlet	2 years	End June July	Disc	4ins.	Good
4.—Watson, Bros., Nungarin	Salmon Gum and Gimlet	2 years	July	Sundercut	4ins.	Fair
5.—R. C. Fitzpatrick, Nungarin	Salmon, Gimlet, Morrell, Jam	2 years	July	Sundercut	4ins.	Good
6.—Creagh, Bros., Quelkan	Salmon, Gimlet, Morrell	2 years	June	Disc	3ins.	Hard and dry
7.—G. H. Herbert, Nungarin	Morrell, Salmon, Gimlet	2 years	Mid June	Scarifier	2ins.	Hard, very dry
8.—A. G. Reynolds, Mukinbudin	Salmon, Gimlet, Mallee, Jam and Scrub	3 years	Early June	Sundercut	3½ins.	Good
9.—H. J. Muhs, Nungarin	Salmon Gum and Gimlet	2 years	July	Sundercut	4ins.	Good
10.—L. Dunsday, Talgomine	Gimlet and Tea Tree	2 years	March 1928	Disc	4ins.	Dry
11.—H. P. Jolly, Mangowine	Morrell, Salmon Gum and Gimlet	2 years	July	Mouldboard	4ins.	Good
12.—J. Mulqueeny, Lake Brown	Salmon Gum and Gimlet	2 years	Early July	Sundercut	3ins.	Good
13.—W. J. Duthie, Mukinbudin	Salmon Gum and Gimlet	2 years	July	Disc	3ins.	Good
14.—J. Richardson, Nth. Mukinbudin	Blackbutt, Tea Tree, Salmon Gum	2 years	June–July	Disc	4ins.	Good

NUNGARIN AGRICULTURAL SOCIETY—*continued.*

FALLOW COMPETITION, 1928–29—*continued.*

Competitor and District.	Cultivations.	Points. Moisture.	Mulch.	Absence of weeds.	Consolidation.	Uniformity of Preparation.	Total.
		40.	10.	10.	20.	20.	100.
1.—G. T. Young, Talgomine	Sundercut end of August. Scarified and harrowed September. Springtyned and harrowed end of September. Harrowed in February	37	9	9	18	19	92
2.—F. A. Williams, Mangowine	Harrowed behind scarifier and scarified and harrowed in August	36	9	8	19	19	91
3.—J. H. Johnson, Mangowine	Springtyned end of July and end of August	36	9	8	19	18	90
4.—Watson Bros., Nungarin	Combined in October	35	8	9	19	18	89
5.—R. C. Fitzpatrick, Nungarin	Springtyned in September, rolled and harrowed in October. Harrowed in February	35	8	8	19	19	89
6.—Creagh Bros., Quelkan	Skim ploughed early September. Combined end of September	35	8	8	19	18	88
7.—G. H. Herbert, Nungarin	Scarified July and again in August. Harrowed in February	35	8	7	19	19	88
8.—A. G. Reynolds, Mukinbudin	Combined end of July and September. Light harrows behind implement	34	8	8	19	19	88
9.—H. J. Muhs, Nungarin	Sundercut end of August. Springtyned (portion) in February	34	8	8	19	18	87
10.—L. Dunsday, Talgomine	Reploughed early August (dry)	33	8	8	18	18	85
11.—H. P. Jolly, Mangowine	Harrowed August. Springtyned end of October. Harrowed in February	32	7	8	19	18	84
12.—J. Mulqueeny, Lake Brown	Springtyned Mid August. Harrowed end August. Harrowed January	32	7	8	19	17	83
13.—W. J. Duthie, Mukinbudin	Springtyned in August and October	30	8	7	18	19	82
14.—J. Richardson, Nth. Mukinbudin	Portion reploughed in August	31	7	9	17	17	81

A review of the data in the above table reveals that the competitors appreciate the value of early fallow, for all the competitors fallowed during June and July with the exception of one entry, which was disced dry in March, 1928.

The disc type of plough was used by ten competitors, five being sundercuts. Two used mouldboards, one of which was used in preparing the winning fallow, and two favoured the scarifier. Discs are not good implements to use on land of the morrell type on account of difficulty of keeping them from going in too deep. The scarifier on the other hand, is proving to be a very suitable machine for that class of country.

The fallows this year were rather weedy, Mustard and Barley Grass being chiefly in evidence, while the Potato Weed was present on a few fallows. It is very difficult economically to control weeds without the aid of sheep, and only six competitors owned sheep. However, now that the district is being reticulated with water from the several rock catchments, it is expected that there will be a big increase in the numbers of sheep.

It is surprising to find that only one competitor is farming on a three-year rotation. This may be due to some extent to the lack of sheep. The diseases "Take-all" and Flag Smut are both becoming prevalent, and the best way to eradicate them is to adopt a rotation including a change crop, such as oats, to starve the diseases out. To render the oats a commercial proposition, sheep are necessary.

DOODLAKINE-BAANDEE FALLOW COMPETITION, 1928-29.

Judge: A. WILD, B.Sc.(Agric.), Agricultural Adviser.

The fallow competition conducted by the Doodlakine-Baandee Agricultural Society during 1929 was characterised by an unusual condition, viz., that the area of fallow of each entry was to be not less than one quarter of the total area of cultivable land held by the competitor. The object of this condition is to stimulate a wider interest in the whole of the fallowed land, rather than in a small area of 50 acres to which special attention can be given. Since the fallow inspected for each competitor was frequently in more than one paddock, the work of the judge became somewhat complicated. In some cases the same competitor submitted, as the one entry, paddocks which had received different cultivations, and in consequence were in different conditions of preparation. It was found necessary to pay due regard to this, and consequently to award points to each paddock as a separate entry and then to arrive at an everage for the whole of the entry.

The fallows were inspected on the 6th and 7th of March. The monthly rainfalls as recorded at Doodlakine and Baandee from June, 1928, to February, 1929, as shown hereunder:—

—	1928.							1929.	
	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Doodlakine ...	76	273	101	73	13	...	97	...	169
Baandee ...	53	244	165	49	11	...	9	...	*

* No record available.

The awards were made as follow:—

DOODLAKINE-BAANDEE AGRICULTURAL SOCIETY.

FALLOW COMPETITION, 1929.

Competitor.	Address.	Moisture 40 points.	Mulch, 10 points.	Absence of weeds, 10 points.	Consolidation of seed bed, 20 points.	Uniformity of Preparation, 20 points.	Total, 100 pts.
1—F. Birch	Baandee ...	35	9	10	16	19	89
2.—Prowse Bros. ...	Doodlakine ...	35	8	8	18	17	86
3.—A. E. C. Prowse ...	Doodlakine ...	34	8	8	17	17	84
4.—R. Barton & Sons ...	Baandee ...	34	8	7	17	17	83
5.—H. Birch	Baandee ...	34	8	8	16	17	83
6.—E. W. Prowse ...	Doodlakine ...	34	7	8	16	16	81
7.—H. Maddeson & Sons	Baandee ...	28	7	7	17	17	76
8.—D. J. Spillman ...	Baandee ...	28	7	7	17	16	75

The cultural and other details of the fallows inspected are set out in the table hereunder:—

DOODLAKINE-BAANDEE AGRICULTURAL SOCIETY.

FALLOW COMPETITION.

Competitor.	F. Birch.	Prowse Bros.	A. E. C. Prowse.	R. Barton & Sons.
Cultivable area ...	1,400 acres.	4,300 acres	1,220 acres	1,570 acres
Total area of fallow	700 acres	1,240 acres	490 acres	700 acres
Area of fallow inspected	350 acres	1,090 acres	400 acres	400 acres
Land and timber...	Salmon Gum and Gimlet	Salmon Gum, Gimlet, Mallee and scrub	Salmon Gum, Gimlet, with some Mallee and White Gum	Salmon Gum, York Gum and tea-tree
Fallowing period ...	June and July	June and July	June and July	July to Sept.
Type of Plough ...	Mouldboard	Mouldboard and Disc	Mouldboard and Disc	Disc.
Depth of ploughing	3—4ins.	3½ins.	3½ins.	4ins
Sheep	Yes	Yes	Yes	Yes
	Springtyne cultivated to full depth of ploughing in August. Rolled in January. Scarified in February after rain.	*Paddocks* 1 and 2: Springtyne cultivated and rolled in August. Harrowed in February. *Paddock* 3: Springtyne cultivated in August. Disc cultivated in September. Portions rolled, and all harrowed in February. *Paddock* 4: Disc cultivated in August, and portion in September. Harrowed in February.	Springtyne cultivated at end of March.	Scarified in August, Springtyne cultivated in October. Harrowed in February.

Competitor.	H. Birch.	E. W. Prowse.	H. Mableson & Sons.	D. J. Spillman.
Cultivable area ...	1,400 acres	1,600 acres	1,600 acres	2,400 acres
Total area of fallow	680 acres	600 acres	640 acres	900 acres
Area of fallow inspected	350 acres	400 acres	400 acres	600 acres
Land and timber	Salmon Gum, Gimlet and some Mallee	Salmon Gum and Gimlet	Salmon Gum and Gimlet with some Morrel	Salmon and Gimlet, Scrub and Mallee
Fallowing period ...	July	June and July	June	June—August
Type of Plough ...	Mouldboard	Disc	Duckfoot Cultivator	Disc
Depth of ploughing	3½—4ins.	3½ins.	2in.	3½ins.
Sheep	Yes	Yes	No	Yes
	Cultivated in September and again in October with springtyne and scarifying implements.	Springtyne cultivated in August and portion in February.	Springtyne cultivated in August and again in September and October.	Disc cultivated in September.

Mr. F. Birch secured first place with 350 acres of fallow, which had been ploughed to a depth of three to four inches during the previous June and July with a mouldboard plough. Immediately this operation was completed, the land was cultivated to the full depth of ploughing with a springtyne implement. A deep cultivation with a springtyne implement tends to bring the clods to the surface and allows the finer soil particles to reach the bottom of the fallow to form the seed bed, which in time becomes satisfactorily compacted. Care should be exercised that subsequent cultivations do not disturb this seed bed.

Mr. Birch's fallow was rolled in January to break up the surface clods. In February it was scarified after rain had fallen. The entry was fairly high in moisture content, had a well prepared surface mulch, and practically no weeds were apparent. The uniformity of the preparation of the whole of this entry is worthy of favourable comment.

Messrs. Prowse Bros. entry, which was awarded second place, comprised about 1,100 acres which had also been ploughed during the previous June and July, when both disc and mouldboard ploughs were used. The major portion had been springtyne cultivated in August, but on a portion the disc implement had replaced the springtyne. Subsequent to the August cultivation a portion had been rolled and the remainder disc cultivated. Practically the whole area had been harrowed in February after rain. Quantities of "Prickly summer weed" (*Solanum hoplopetalum*) were noticed in two of the smaller paddocks, but the remainder of this entry was comparatively free of weed growth. The harrows had left a fair mulch although a little too flat. One of the advantages of using the springtyne implement in preparing and maintaining a mulch lies not least in the fact that the soil is left slightly ridged, consequently, after rain, a cross cultivation of the land thus prepared is more effective in reforming the mulch to the desired condition.

It is pleasing to note that most of the competitors in this fallow competition utilise the services of sheep before and during the fallowing period to control weed growth. The aim of the competitors was to plough their land for fallow as early as possible, preferably in June or July. The recognition of this practice as an aid to greater fertility and productivity is gratifying in the light of the results of experiments conducted by the Department of Agriculture.

The dry spring of 1928 was not favourable to frequent cultivations during that period. The cultivation of fallow in the dry state is inadvisable, not only is it thought to assist in the spread of "Take-all," but usually no good results can be achieved by the practice. Consequently, the number of cultivations, prior to the inspection and subsequent to the initial ploughing, varied from one to three. A cultivation in spring and another after February rain was deemed by most of the competitors to be sufficient.

POTATO DISEASES IN WESTERN AUSTRALIA.

H. A. PITTMAN, B.Sc.Agr.,
Plant Pathologist.

INTRODUCTION.

According to the figures given by the Government Statistician in Part 5 of the "Statistical Register of Western Australia" for the Seasons 1921-2 to 1927-28, both inclusive, the average annual area under potatoes during this period was 4,543 acres, with an average yield over the whole period of 3.7 tons per acre.

The figures for the various seasons mentioned were as follows:—

Season.*	Acreage.	Yield per acre in tons.
1921-2	3,612	3.8
1922-3	3,620	4.2
1923-4	4,761	3.7
1924-5	5,122	3.9
1925-6	4,262	3.8
1926-7	5,143	3.5
1927-8	5,279	3.2
1921-8	4,543	3.7

Such a low average yield is undoubtedly due in a large measure to the prevalence of diseases of various kinds. This is borne out by the fact that the average yield obtained by growers using Government-certified seed since the inception of the Seed Certification Scheme, three years ago, as computed by Mr. G. N. Lowe, Senior Potato Inspector, has been from 8-10 tons per acre. Where the manurial and cultural treatments have been identical, certified seed has constantly given a yield of from four to five tons per acre over that of non-certified seed grown alongside. This is very largely due to the elimination of virus and other diseases in the process of producing the certified seed. In fact the elimination of disease, in so far as may be humanly possible, constitutes the chief "raison d'être" or justification for the existence of the Seed Certification Scheme. Yields as high as approximately 23 tons per acre have been obtained by the use of certified seed. This seed is now being grown over an area of approximately 1,000 acres with most gratifying results.

Up to date the highest yield recorded for Western Australia has been obtained by the use of certified seed, and was at the rate of 23 tons 7 cwt.

**For the purpose of the statistical records, the season is taken as commencing on the 1st March in each year.*

per acre, the same grower having taken 40 tons off two acres. Such yields are, of course, only obtained by a combination of the following factors:—

1. Suitable soils and localities.
2. Seed selection—preferably the use of Government-certified seed.
3. Seed disinfection before planting.
4. Racking of the tubers to secure sprouted seed.
5. Careful preparation of the soil, including adequate drainage.
6. Adequate manuring.
7. Careful cultivation during the growth of the crop.
8. Intelligent use, when required, of spray mixtures to control such diseases as Early and Irish Blight.

DISEASES.

The following diseases of potatoes have been recorded on potatoes in this State. The cause and control measures to be adopted for each are described hereafter.

Name of Disease and Cause.

Rhizoctonia Scab, Canker or Rosette—*Rhizoctonia solani.*
Common Scab—*Actinomyces scabies.*
Eelworm Scab—*Heterodera radicicola.*
Silver Scurf—*Spondylocladium atrovirens.*
Dry Rot, Brown Ring or Fusarium Wilt—*Fusarium oxysporum.*
Early Bight—*Macrosporium solani.*
Bacterial Wilt (Wet Rot)—*Bacillus solanacearum.*
Irish Blight—*Phytophthora infestans.*
Blackleg—*Bacillus atrosepticus.*
Mosaic— Ultramicroscopic parasite (virus).
Leaf-roll—Ultramicroscopic parasite (virus).
Streak—Ultramicroscopic parasite (virus).
Hollow Heart—Excessive rate of growth in coarse varieties.
Fleck (Internal Brown Spot or Sprain)—Unknown.
Hot Formalin injury—Tubers left covered too long after treatment.

1.—RHIZOCTONIA SCAB, ROSETTE OR STEM CANKER.

(Caused by *Corticium vagum* B. & C.—*Rhizoctonia solani,* Kuhn.)

This disease is the most widespread of all potato diseases, and it has been recorded from every part of the world where potatoes are grown commercially. The fungus responsible for the trouble is known scientifically by either of the two names given above. The first name is applied to the fungus when in the sexual condition, while the second name is that which is applied to the fungus in its much more common sterile condition. Many other plants beside the potato are attacked, and amongst those which have been recorded in various parts of the world are beets, carrots, lucerne, red-clover, onion, raspberry, turnips, peas, celery, lettuce, beans, cabbage, carnations, parsnip, rhubarb, violets and spinach (Chupp, 1925). In America losses ranging from 5 to 50 per cent. of the potato crop in various districts have often been recorded on account of the ravages of this parasite. In

Western Australia the disease has only become of serious moment during the past few years, as Herbert in 1920 stated that "*Rhizoctonia* is not common here though frequently found in imported potatoes." To-day it ranks with such diseases as Mosaic and Leaf-Roll as one of our most potent and persistent causes of loss.

Symptoms shown by affected plants.

The disease is best known to the grower and to the general public as hard, sooty-black scabs or fungus-bodies on the surface of the tubers, which will not readily rub or wash off. These black bodies, which really represent resting stages in the life history of the fungus, are frequently very numerous and give the affected tubers the appearance of having been more or less thickly sprinkled with irregular drops of molten pitch or tar. (See Fig 1.)

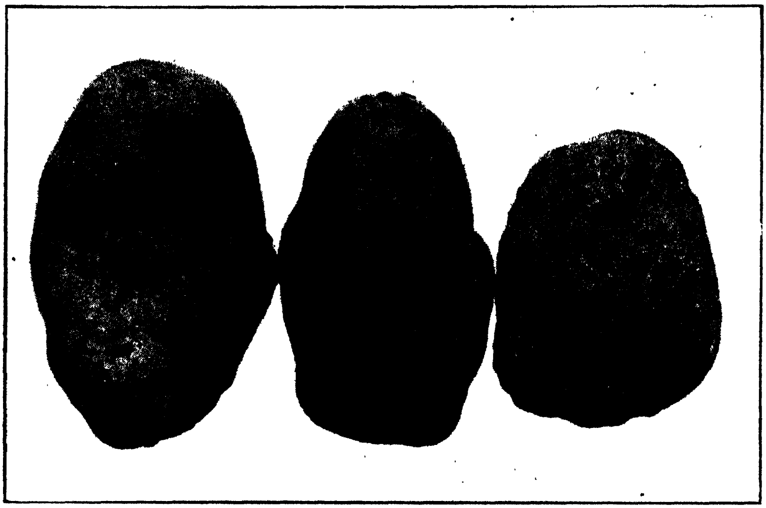


Fig 1.—(Potato Diseases in W.A.)
Potato tubers showing black *sclerotia* of *Rhizoctonia solani.*
(Photo. by Author.)

They are known as *sclerotia,* and may vary in size from mere pinpoints up to huge structures occasionally covering an area of several square inches. As they do not penetrate the skin, they are in consequence removed when the tubers are peeled. Nevertheless, their presence is detrimental to the market value of the tubers, as they considerably detract from their appearance. Their presence on seed tubers is, however, fraught with a far greater potentiality for evil than in the case of tubers sold merely to be consumed. When infected tubers are planted the *sclerotia* give rise to brown fungus threads which work their way along the surface of the tubers, or through the soil, to the young potato shoots and proceed to attack them at the tips or else lower down, causing a dark brown or black canker (see Fig. 2). The result is that many of the shoots are killed, and a greatly reduced stand may result. *This constitutes the most serious aspect of the Rhizoctonia*

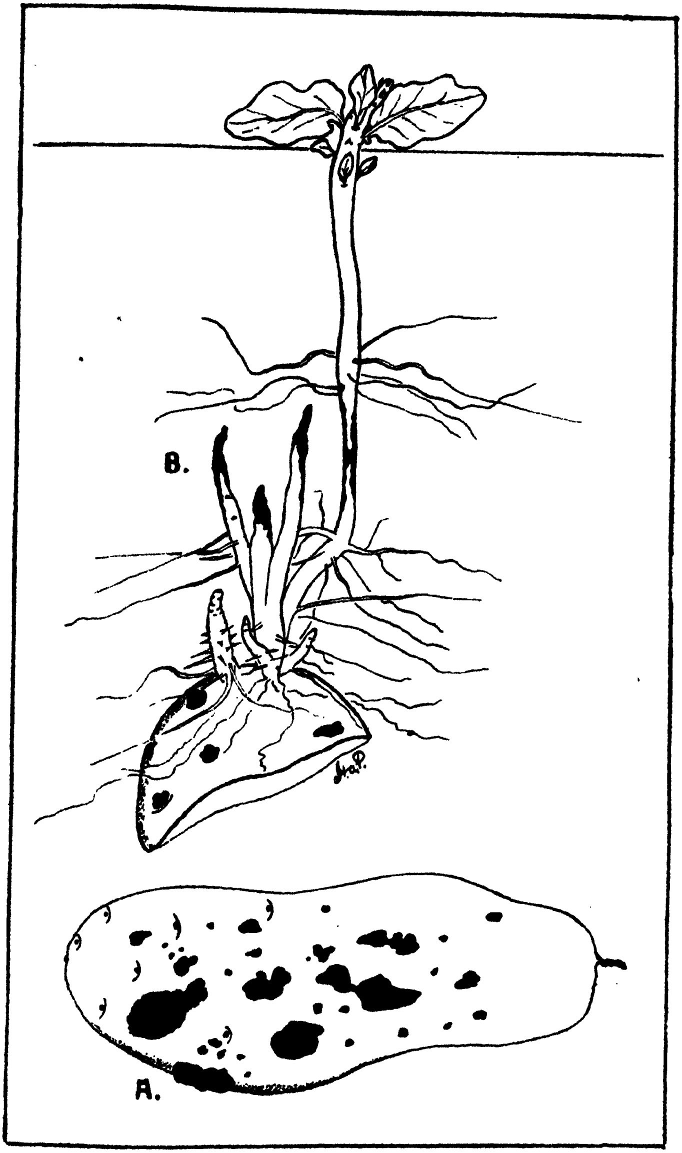


Fig. 2.—(Potato Diseases in W.A.)

A.—Potato tuber showing bad attack by *Rhizoctonia.*

B.—Germinating set showing the killing-back of the sprouts and stem-cankering which occurs when *Rhizoctonia*-infested tubers are planted. *The resultant missing hills or weakling plants constitute the most serious aspect of the Rhizoctonia disease.*

(Drawing by Author.)

disease. The attacked shoots often throw out new buds lower down, and these may in turn be attacked. This attacking and renewed growth may be repeated a number of times until the sprout is finally killed altogether, resulting in a missing hill, or the plant mav break feebly through the soil a long time after the healthy hills are up. These weakling yellow plants can never yield a profitable return.

If the base of the stem is not infected until the plant has gained considerable size, it may not be killed but a shortening of the internodes at the growing point may result (as a consequence of the reduced water supply, etc., reaching the growing tissues), and a massed or rosette effect may be given to the topmost leaves. These leaves may turn yellow or remain the normal green. Where the canker on the stem does not penetrate deep enough to shut off or reduce the supply of water and dissolved minerals, but does penetrate deeply enough to interfere with the movement of sugars down to the tubers, there may result an accumulation of plastic food materials in the top of the plant. In an endeavour to propogate itself, or at least find an outlet for this accumulation of food materials, tubers known as "aerial tubers" may be formed in the leaf axils on the above ground parts of the stems. In very wet weather the fungus may form a white cob-webby sheath of threads about the base of the stem. This is the reproductive stage of the fungus known as *Corticium vagum.* So far this stage has not been recorded in Western Australia.

It is said that *Rhizoctonia* may cause pitting of the surface of the tubers, but this seems to be very doubtful. The fungus is also accused of causing a "jelly-end rot" where the tubers are abnormally elongated at the stem end.

General Considerations.

Rhizoctonia attack is greatly influenced by the environmental conditions. In this connection temperature often appears to be the most important factor. The temperatures at which the fungus does most injury are between 59-70° F. Other things being propitious the fungus is most destructive at a soil temperature of 64° F. It thrives best in acid soils, and on this account liming gives good results in its control. Unfortunately the position is complicated by the fact that Common Scab (*Actinomyces scabies*) is *favoured* by liming, and so in avoiding *Rhizoctonia* in this way, one encourages *Actinomyces.* In spite of the fact that acidity favours *Rhizoctonia,* heavy dressings of farm-yard manure, or organic matter such as green manures, appear to considerably reduce the occurrence of the disease. Fortunately the same appears to be true of *Actinomyces.* In both cases the provision of abundant dead organic matter seems to divert the unwanted attentions of the parasites into other more desirable channels.

Control.

As *Rhizoctonia* is at present so very widespread, and as it may be present on the tubers as a fine, branched, mass of threads which can only be detected by the microscope, all seed-tubers should be treated as if *Rhizoctonia* were definitely known to be present.

The following measures are recommended for its control:—

1. Wherever possible practise rotation of crops. This is one of the most effective means of controlling any plant disease. Cereal crops, such as wheat, barley, oats, rye, maize and sorghum are not susceptible to *Rhizoctonia* attack.

2. Use only selected, *Rhizoctonia*-free, seed-tubers. Best of all, use Government-certified seed. This is obtained from the cleanest, heaviest-yielding crops in the country, and contains only the ineradicable minimum, if any, of such diseases as Mosaic, Leaf-roll, Thready-eye, *Rhizoctonia,* Common Scab, Potato Moth, Irish Blight, etc.

3. Harvest as soon as mature to prevent increase in the number of *sclerotia* on the surface of the tubers.

4. Religiously disinfect all seed tubers before planting, irrespective of their source of origin, in one or other of the following ways:—

A.—*Hot Formalin Dip*—

Dip the tubers in a solution of formalin made from 1 quart of formalin to 30 gallons of water and heated to 120° F. Keep the tubers immersed *for two minutes,* and then place in heaps under bags damped with the formalin solution *for one hour only.* Remove the bags at the end of the hour and place the tubers on racks to dry. Treat at least 10 days before sowing, and before tubers are sprouted. The tubers may be immersed in the hot formalin solution in the bags, and after removing from the solution can be left in the bags for one hour. They must then be *immediately turned out to dry or considerable damage may result to the tubers. If the directions are carefully followed, no damage to the tubers will result.* Formalin may be used in metal containers without any danger of corrosion taking place. A supply of the stock solution, both hot and cold, should be at hand in order to more readily keep the correct temperature in the dipping tank. A carefully regulated fire may be used beneath the tank to keep the temperature around 120° F.

B.—*Cold Mercuric Chloride Dip*—

This is more effective than the formalin dip, but it is also somewhat more dangerous to use. In addition, it has the disadvantage that it rapidly corrodes metal containers (unless they are painted or lined with pitch, tar or asphalt-roof paint), and it can only, therefore, be used, as a general rule, in wooden, glass or earthenware vessels. **Mercuric chloride is deadly poisonous to human, animal or plant life. In addition it is colourless, odourless and comparatively tasteless, and may easily be mistaken for pure water. It should, therefore, be used with great care and kept out of the reach of children or farm stock. When finished with, the solution should be poured into a hole in the ground, and the hole be immediately filled in or covered over. In case of mercuric chloride poisoning give whites and yolks of eggs mixed with milk. In emergency, ordinary flour paste may be used. Send immediately for medical assistance.**

The solution for seed treatment is made up by using four (4) ounces of corrosive sublimate (mercuric chloride) in thirty (30) gallons of water. The seed tubers are soaked in this solution for an hour and a-half. The solution is used to treat three batches of potatoes, and is then discarded

and a new lot of solution made up. The temperature during treatment should be not less than 45° F nor more than 70° F. If the temperature of the water is more than 70° F., the time of treatment must be reduced.

The tubers must be dried thoroughly after treatment by being thinly spread out on racks, etc., or the action of the poison will continue and damage to the seed will result. The crystals or powder may be easily dissolved in a little hot water, enough cold water being then added to make the thirty gallons.

Convenient vessels for treating the seed are wooden barrels or vats with wooden bungs at the bottom to drain out the liquid after the third lot of tubers has been treated. Cement or unprotected metal containers must not be used.

Keeping up the strength of the Solution.—Some growers prefer to add a little more corrosive sublimate after treating every second bag, rather than make up a new solution after every third bag. This is not recommended as a general rule, but if the grower desires to use this method, it has been the practice to advise the addition of three-eighths of an ounce of sublimate to each thirty gallons after treating every second bag. This scheme cannot be regarded as satisfactory, as the solution may easily become too weak to be effective, or so strong that injury to the tubers results. For these reasons a simple chemical test devised by Cross for determining the exact amount of corrosive sublimate to add from time to time is given at the end of this article, and is very strongly recommended. The cost of the materials required is low, and the method is interesting and simple. Any grower operating on a big scale should certainly adopt this accurate method as a big improvement over the uncertain hit-or-miss procedure of the past. The method has been tested out in this laboratory, and gives good results.

C.—*Hot Corrosive Sublimate*—

This is the most recent and apparently also the most successful method of treatment of tubers as a preventative against *Rhizoctonia*. The treatment necessitates a wooden tank being used. The strength of the solution is the same as in the cold dip, *i.e.*, four (4) ounces of sublimate to thirty (30) gallons of water, but the solution is heated to 126° F. by injecting steam through a rubber hose from a small boiler or heating plant. The potatoes are dipped for *two minutes* in wooden crates, and are then spread out thinly to drain and dry. The tank used must have a water capacity considerably in excess of the volume of the tubers to be treated at any one time, so that the temperature can more easily be kept uniform. All metal parts of the crates, etc., must be coated with asphalt-paint, tar or pitch to prevent corrosion.

It is not anticipated that many growers will be in a position to adopt this treatment at present, but the method is indicated so that progressive large-scale farmers may take advantage of this information if they so desire, and consider that the saving in time, etc., is worth the expense of the treatment. If adopted, the strength of the solution must be kept up from time to time as indicated above, or better still according to the method given below.

The "Cross" Method of determining the correct amount of Corrosive Sublimate to add to the tanks to keep the correct strength.

Have a chemist make up a solution in the following way:—Dissolve 5 grammes of potassium iodide in 1,000ccs. of water. To this solution then add one gramme of copper sulphate previously dissolved in a little water.

To use the solution take 10 ccs. in a 50 cc. measuring-cylinder. From a small lipped vessel such as a glass beaker or small china jug, slowly add to this the prepared corrosive sublimate solution, drop by drop, until an orange-red precipitate is formed. If both the chemist's solution and the disinfectant are of the correct strength, it should take 20 ccs. of the disinfectant to produce the orange-red deposit. Write down the actual amount required before dipping the first lot of potatoes, and then wash out the measuring-cylinder with clean water. After using the sublimate solution for dipping one or two lots of tubers make another test in the same way as before, after first bringing the solution in the tank up to the original level. The dipping solution will now be somewhat weakened, and consequently it will take more of the corrosive sublimate to produce the precipitate now than it did before.

Let us assume that exactly 20 ccs. of corrosive sublimate were required the first time. The second time, for sake of argument, 22 ccs. might be required. The disinfectant must now, therefore, be only 20/22 = 10/11ths. as strong as it was before the tubers were dipped. It is obvious, therefore, that it has lost 1/11th of its strength, and to bring up the strength to the correct amount, 1/11th. of 4 ounces = 4/11th. of an ounce = approximately 1/3rd of an ounce of corrosive sublimate must be added to every thirty gallons of the disinfectant solution. The sublimate solution must be tested in this way after every second bag, and the calculated amount of corrosive sublimate crystals added before dipping any more bags. The method is much simpler in practice than it appears in print.

2.—COMMON SCAB.

(Caused by *Actinomyces Scabies* (Thax.), Güssow.)

This disease is found not only on the potato, but has also been recorded by various observers on beetroot, turnips, mangels, rutabagas, parsnips, radishes and carrots amongst others. On potato, the disease is fairly common in Western Australia in certain districts, and especially so where the tubers are grown on soil which has been rendered somewhat alkaline by liming, or by the burning-off of the native vegetation.

Symptoms.—In typical cases this disease can be readily distinguished from eelworm-scab, which is the only other disease present in this State with which it could possible be confused. The disease is characterised by the presence of roughened and fissured corky areas on the surface, which contrast strongly with the smooth, lighter-coloured, unaffected neighbouring tissue (see Fig. 3). When isolated the diseased areas are generally approximately cylindrical, and they usually show a small series of more or less concentric corky ridges and corresponding fissures. The margins of the lesions are generally ridged up above the level of the surrounding healthy skin (see Fig 4). Only a single lesion may occur on a tuber, but more commonly there are several, and occasionally there may be so many that it is difficult to find an area of unaffected skin. The lesions are said to commence as small

brown specks at the breathing pores or lenticels. From these positions they gradually work outwards, and in the course of time may coalesce and form areas of very great extent (see Fig 5). In bad cases the whole surface of the tuber may be covered with lesions. Secondary organisms frequently then take control and may soon reduce the tuber to a disintegrating rotten mass.

Cause.—As stated above this disease is due to *Actinomyces scabies*. The organism is peculiar in that the genus to which it belongs consists of bacteria which form long thread-like multi-cellular filaments, which strongly

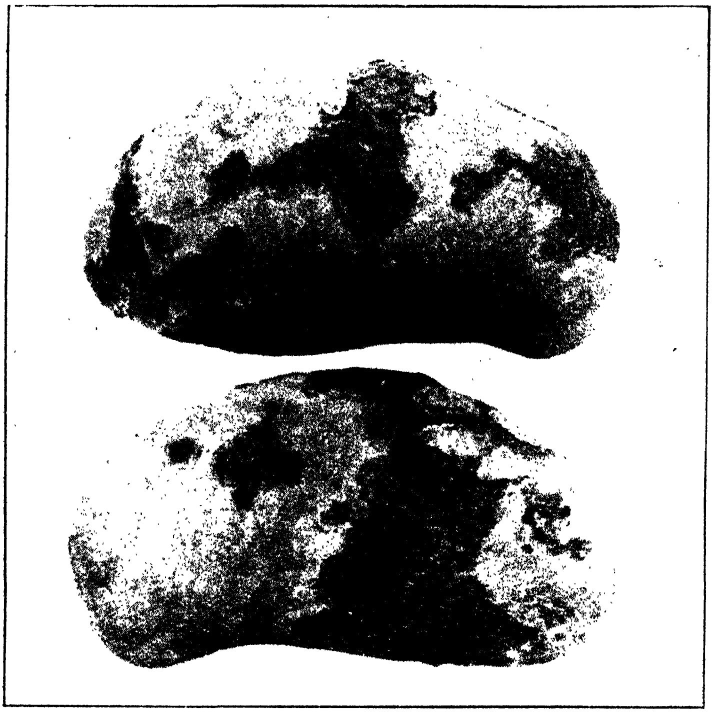


Fig. 3.—(Potato Diseases in W.A.) Common Scab due to *Actinomyces scabies*.

(Photo. by Author.)

suggest the *hyphae* or threads of the higher fungi. These threads very readily break up, however, into normal, unicellular, rod-like bacteria. These are able to live on the organic matter in the soil as well as on the surface of the potato tubers and the underground parts of certain other plants.

General Considerations.—Actinomyces scabies is greatly stimulated by the addition to the soil of lime, wood ashes, or any material which will tend to render the soil alkaline. It is for this reason that potatoes following cabbages or other crucifers, which have been heavily limed for the control of Clubroot (*Plasmodiophora brassicae*), are often badly affected with

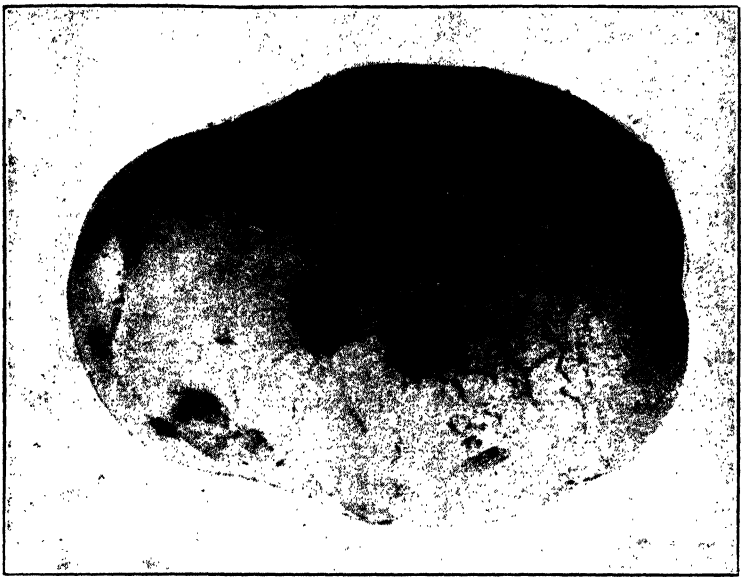


Fig. 4.—(Potato Diseases in W.A.) Common Scab due to *Actinomyces scabies.*

(Photo. by Author.)

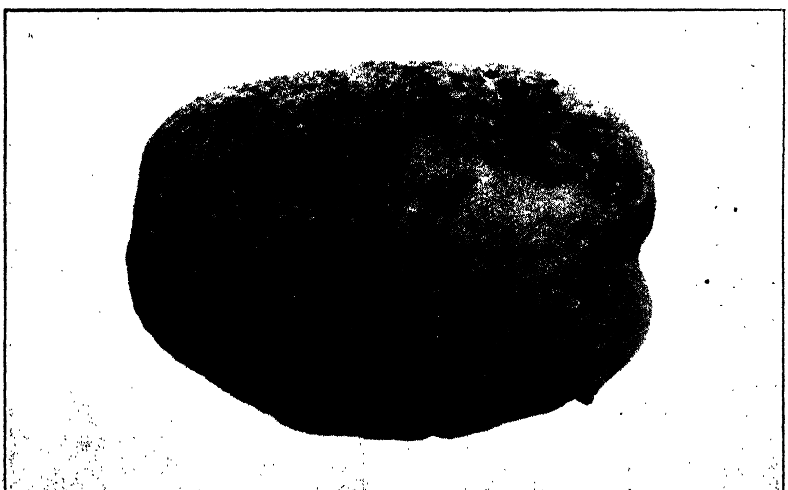


Fig. 5.—(Potato Diseases in W.A.) Common Scab due to *Actinomyces scabies.*

(Photo. by Author.)

Common Scab. Acidity is unfavourable to its development, and therefore, the use of acid fertilisers such as superphosphate, sulphate of potash and sulphate of ammonia will tend to reduce the disease. As nitrate of soda, if used for a considerable period, tends to render the soil reaction alkaline, it should not be used where Common Scab is likely to be in evidence. It is unfortunate that alkalinity is favourable to Common Scab, because by increasing the soil acidity to reduce attack by *Actinomyces*, the effect is to encourage *Rhizoctonia*. It has been shown, however, that attacks by both *Actinomyces* and *Rhizoctonia* are reduced by increasing the organic matter of the soil. The grower therefore should make every effort to increase the humus content of the soil by the incorporation of green manures, etc., if his soil is at all deficient in organic matter.

Common Scab is most serious where the soil temperatures are high. It has been shown that it does most damage—other things being favourable to it—at a soil temperature of about 72° F. Low moisture content appears to favour the disease, so that scab will be most serious under a combination of soil alkalinity, high soil temperature and low soil moisture.

Control—

1. If the soil is badly infested with *Actinomyces* rotate with other crops.
2. Use clean seed. Government-certified seed is the cleanest and best procurable.
3. No matter what the source of origin, treat all the seed tubers with formalin or mercuric chloride (corrosive sublimate) as recommended for *Rhizoctonia* control.
4. Substances tending to cause soil alkalinity such as lime or wood ashes should not be applied to the soil imediately before growing a potato crop. If they must be used they should be applied to other crops preceding the potato crop by as long a period as possible.
5. Every attempt should be made on soils at all deficient in organic matter to increase the humus content by the ploughing-in of green manure crops.
6. Avoid using nitrate of soda as it tends to increase the soil alkalinity. Use sulphate of ammonia or blood and bone instead.

As indicating the effect of acidity in reducing the amount of Common Scab, it is interesting to note that in certain parts of America where potatoes are very often grown for many years without a change of crop, the harrowing-in of from 300 to 450 pounds of inoculated sulphur before the potatoes are planted has given very good control. This treatment has not been tried out in Western Australia, and no recommendation can be made concerning it.

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(Further potato diseases will be dealt with in subsequent issues of the "Journal.")

PIGS AND PIG-RAISING.

P. G. HAMPSHIRE,
Superintendent of Dairying.

The importance of the development of pig-raising as one of the primary industries of Western Australia cannot be too greatly stressed.

In Western Australia we have a deficiency in production of bacon and hams equal to nearly £200,000 per annum. When this exceedingly profitable market has been satisfied, export markets are geographically very favourable to Western Australian pig raisers as compared to the rest of Australia. Great Britain alone imports 420,000 tons of pork, bacon, etc., worth £32,000,000 per annum.

Western Australia has built large modern bacon factories capable of greatly increased output. We have also stud-breeders who have built up studs of high class pigs. The climate is good. Western Australia is a large grain producer, and has now embarked upon dairying on a big scale in connection with group and estate subdivision settlement. Dairying and pig-raising go hand in hand—the pig should represent at least 25 per cent. of the income of a dairy farmer. At least one brood sow should be kept for every three to five cows on a dairy farm.

Pig-raising combines with most branches of agriculture. No farm is complete without the pig. The pig converts waste or unsaleable farm products into excellent human food. The pig is a money-making farm scavenger. There is no need that the piggery should be a place to avoid—a place of offensive odours. People do not often realise that the pig is really a naturally clean animal. A dirty pigsty means a careless owner.

Pigs multiply more rapidly than any other farm animal. The annual increase of cattle is estimated at 80 per cent. to 90 per cent., sheep 95 per cent. to 115 per cent., and pigs 1,500 per cent. to 1,800 per cent.

Pigs produce more edible flesh from a given quantity of food than other animals. It requires 13lbs. of dry matter in the form of food to secure 1lb. of flesh in cattle, 8lbs. to 9lbs. with sheep to produce 1lb. mutton, and 4lbs. to 5lbs. to produce 1lb. of pork.

Pigs when slaughtered dress by far the greatest proportion of edible flesh, compared with cattle and sheep. Sheep dress 55 to 60 per cent., cattle 60 to 65 per cent., and pigs 78 to 80 per cent.

Pigs can be reared and fattened on a smaller area than any other farm animal. The capital outlay in pig-raising is very small in comparison to the income.

BREEDS OF PIGS.

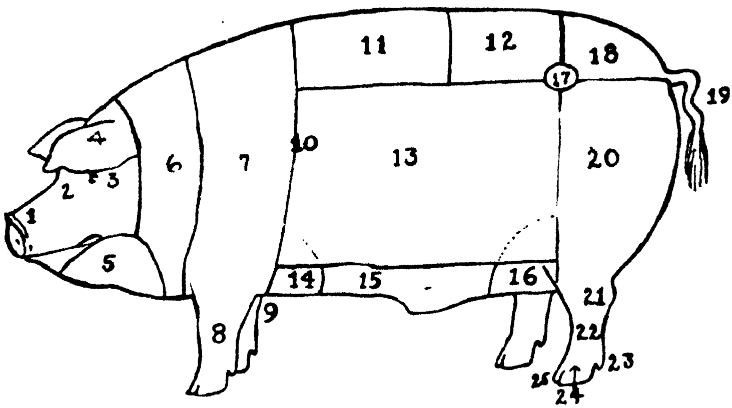
History tells us that swine (*sus scofa*) have existed in a wild state on the continents of Europe, Asia, and Africa since the earliest known period, and with some variation they have been found wild on the continent of America, but were unknown in the early history of Australia. It is generally accepted that the present-day domestic pig is descended from the wild species.

England, which is looked upon as a stud farm of the world, has furnished the majority of the improved breeds of pigs to-day, the origin of the breeds being the old English hog with crosses of foreign wild pigs.

The domesticated pig will revert to the wild state if permitted, but the process is slow, and they do not acquire the solitary habit nor become so fierce as the origin of the species.

The principal breeds of pigs to-day (of English origin) are Berkshire, Yorkshire (Large, Middle, and Small), Tamworth, and Large Black, (of American origin) we have the Poland-China, Duroc-Jersey, and Chester Whites. These vary in colour, and would be classified as follows:—Black: Berkshire, Large Black, Poland-China. White: Yorkshire (Large, Middle, and Small), Chester. Red: Tamworth, Duroc-Jersey.

The main points of difference are size of carcase and bone, size and shape of head, length and thickness of neck, length and depth of body and legs, colour of skin and hair.



Parts of the Pig.

1. Snout or nose.
2. Face.
3. Eye.
4. Ear.
5. Jowl.
6. Neck.
7. Shoulder.
8. Fore leg.
9. Chest.
10. Heart girth.
11. Back.
12. Loin.
13. Side.
14. Fore flank.
15. Belly.
16. Rear flank.
17. Hip.
18. Rump.
19. Tail.
20. Ham.
21. Hock.
22. Hind leg.
23. Dew claws.
24. Pasterns.
25. Toes.

PRINCIPAL BREEDS DESCRIBED.

Berkshire.

One of the oldest of improved breeds, origin Berkshire, England. Principal improvement in Leicestershire and Staffordshire. The original animal was large, similar to Tamworth, coarse of body, and the colour varied. Marked improvement developed early in 18th century, and was principally effected by Richard Astley and Lord Barrington. Berkshire's were first given a separate class at Royal Agricultural Show, England, in 1862. Early writers show that Chinese pigs were crossed with the Berkshire in their im-

provement. The improved Berkshire was greatly used on native swine in Ireland and Scotland, with beneficial results. This breed is most widely distributed and popular throughout the world, and does well in all climates.

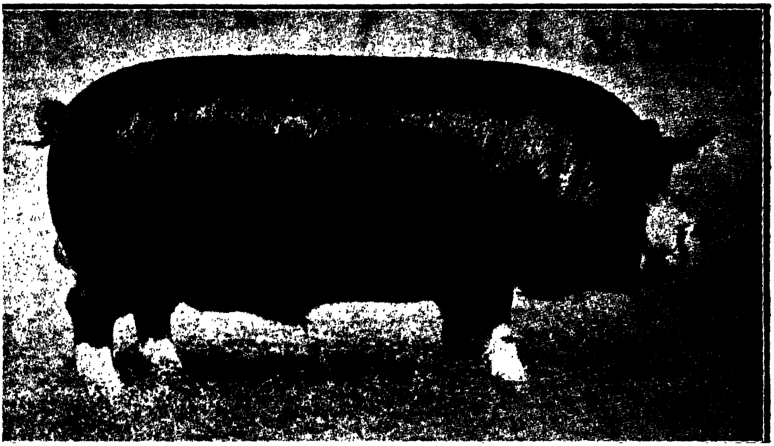
Characteristics—

Size (relative).—Medium: larger than Poland-China, smaller than Large Yorkshire, Tamworth, and Large Black.

Adaptability.—In general adaptability they may be classed at head of all breeds for pork and bacon.

Maturing qualities.—Most excellent. Will fatten at any age.

Grazing and feeding qualities.—Splendid; strong digestive powers enable them to give a maximum return in flesh for food consumed.



A Berkshire Boar.

Quality of meat.—Excellent pork and bacon. Well mixed fat and lean. Dresses well in proportion to live weight.

Value for crossing or "grading-up."—Unexcelled. Most used in this respect. Great value to refine coarse breeds. Quick growers; early maturers.

Breeding qualities.—Medium to good, but vary according to conditions. If not too confined produce fair to good litters, and are fair mothers. Boars are particularly noted for prepotency, and readily impress the young pigs with conformity and early maturing quality.

Principal points—

Head.—Medium, broad, fleshy, good width between eyes, well dished, snout short.

Ears.—Fairly fine, sprightly, cocked, inclined forward, fringed fine silky hair.

Jowl.—Full, firm, symmetrical.

Neck.—Short, broad, muscular.

Shoulders.—Sloping, freedom from coarseness, thick through chest.

Back.—Broad, long, straight or slightly arched.

Barrel.—Ribs well sprung, deep, well let down even side and bottom line deep flank; loins strong.

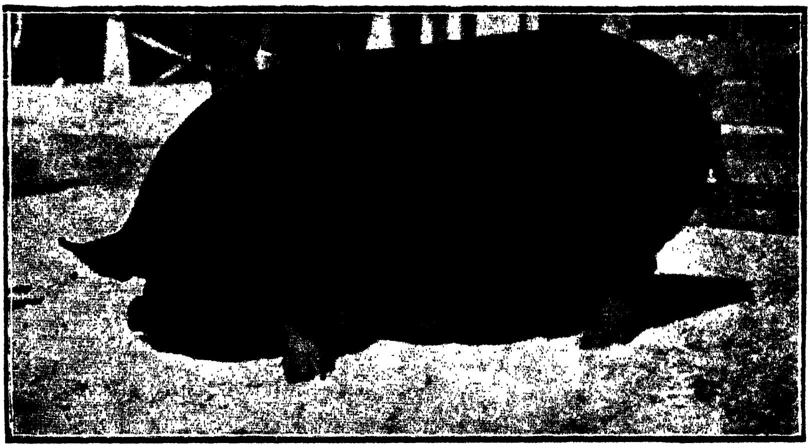
Rump.—Wide, lengthy, square, showing strength.

Hams.—Deep and thick, well let down, joining back with hock.

Legs and feet.—Short, straight, strong, set well apart. Hoofs erect, firm and strong.

Skin.—Smooth, pliable, freedom from wrinkles.

Colour.—Black, with white blaze on face. White feet and white brush of tail.



A Berkshire Sow.

Objections—

Snout.—Long.
Ears.—Flopping, coarse.
Chest.—Narrow.
Shoulders.—Coarse, heavy on top.
Back.—Drooping.
Sides.—Flat, not well let down.
Loin.—Narrow or weak looking.
Rump.—Drooping.
Hams.—Narrow, short.
Legs.—Crooked, weak, close together, round bone.
Feet.—Weak, flat.
Hair.—Coarse, curly, bushy fringe on neck.
Action.—Sluggish, clumsy.

Disqualifications—

Colour.—White, irregularly placed. Reddish hair or spots.

(*To be continued.*)

SEAWEED AS A FERTILISER.

L. J. H. TEAKLE (Plant Nutrition Officer) and L. J. NEWMAN (Entomologist).

On account of the danger of introducing Buffalo Fly (*Lyperosia exigua*) in the manure and litter from the cattle boats from the North-West, the landing of this material was prohibited in 1927. This action caused considerable hardship to the growers in certain districts, where they were relying on supplies from the boats to maintain the humus of their soils. As a result of a public meeting to consider the matter, the Minister for Agriculture, Hon. H. Millington, promised the assistance of Departmental Officers to determine the fertilising value of the seaweeds which accumulate along the beaches, to be used as a substitue for Stable Manure. Local reports indicated that seaweed was unsuitable as it would not decompose when applied to the soil. These investigations are the outcome of that promise.

The Use of Seaweed in Other Countries.—A review of the literature showed that seaweed is used successfully in many parts of the world in the immediate vicinity of the coast. The water content of the material collected on the beaches is very high, three quarters of the weight of the seaweed being water. This means that the handling and cartage is expensive—too expensive to allow of haulage for more than a few miles. Records show that seaweed washed with fresh water was used as a manure by the early Romans. Seaweed is still used extensively in the Channel Islands, and on the coastal soils of Great Britain, Ireland and France. It is of great importance along the New England coast in North America, and is used to some extent in Canada, Norway and the Eastern States of Australia. In these localities it is valued on account of its freedom from weed seeds and plant diseases and also on account of the fact that it decomposes much more readily than stable manure. In some districts it is valued at as much as £2 per ton. As a manure it is used very largely on early potatoes. To a lesser extent dressings are used for corn, mangolds and other roots, vegetables etc.

Applications range from 10 tons to 50 tons per acre of the moist material, averaging 25 tons to 30 tons per acre for early potatoes. It is usually supplemented by superphosphate or guano. It may be applied directly to the soil, or composted in pits or heaps covered with soil to rot before being used. When ready it is dug or ploughed into the soil. *Its main value lies in its power to increase the moisture holding power of light, sandy soils.* In addition it is valuable in that it materially increases the power of retaining such manures as ammonia and potash applied to these soils. It is relatively poor in nitrogen and very poor in phosphate. Potash is relatively abundant. Analyses indicate that seaweeds collected in early Spring are of superior fertilising value.

A botanical examination shows that seaweed in the Northern Hemisphere consists chiefly of true Algæ, Fucus predominating. Irish Moss (Chondrus crispus) is most highly valued as a source of manure in New England. Laminaria spp. or ribbon weeds are kelps of less manurial value.

The "Seaweeds" in Western Australia."—Before commencing experiments in Perth the seaweeds were examined botanically by Miss Reed of the University and chemically by the Government Analyst. It was found

that the material consisted of two Sea Grasses (Posidonia Australis and Cymodocera Antarctica), true seaweeds being entirely absent. Chemically the seagrass was very high in ash, which consistutes 50 to 60 per cent. of the dry matter. It was low in the fertilising ingredients, nitrogen, phosphate and potassium. The bulk of the ash consisted of calcium carbonate (limestone). The actual analyses reported by the Government Analyst are given in Table I.

TABLE 1.

Composition of seagrass obtained from the beach south of Fremantle, August 1928. (Results expressed as per cent. on a moisture free basis).

	Sample 1 per cent.	Sample 2 per cent.
Total Ash	51	62
Total Nitrogen (N)	0.56	0.44
Total Phosphorus (P)	0.066	0.063
Total Potassium (K)	0.31	0.10
Calcium Carbonate ($CaCO_3$)	35	47

Note.—Sample 2 had been washed with tap water to remove salt. This accounts for the loss of potassium.

One ton of Western Australian seagrass at 75 per cent. moisture compared with Cow manure at 77 per cent. moisture will supply:—

	Seagrass	Cow manure
Organic Matter	250 lbs.	500 lbs.
Nitrogen (N)	3.1 lbs.	11.2 lbs.
Phosphorus (P)	0.37 lbs.	3.4 lbs.
Postassium (K)	1.8 lbs.	13.4 lbs.
Calcium Carbonate ($CaCO_3$)	224 lbs.	nil

This seagrass is of low value as a source of fertiliser. Will seagrass rot under favourable conditions?

In order to determine whether seagrass will rot when placed under favourable conditions, three tons of the material were secured from the beach South of Fremantle. It was decided to test:—

1. The effect of washing out the soluble sea salts.
2. The effect of treating the original and washed material with:—
   - (a) Stable Manure, 10 per cent.
   - (b) Garden Sand, 10 per cent.
   - (c) Adco, 1.5 per cent.
   - (d) Stable manure, 10 per cent., plus Adco, 1.5 per cent.
   - (e) Garden sand, 10 per cent., plus Adco, 1.5 per cent.

in comparison with samples moistened with water only.

Experiments were carried out in pits, to be on a practical scale, and in pots, for ease of handling.

The pits were dug in a section of Government Gardens to a depth of three feet and then filled with approximately half a ton of the moist sea grass intimately mixed with the various additions as required. A covering of sand was applied and the pits kept moist by frequent waterings.

For the pot experiment two series of 10 inch flower pots were used. In one series the seagrass, as it came from the beach, was used; in the other, seagrass, which had been leached for one hour with tap water.

Each series was treated as in the pit experiment, the seagrass being mixed with weighted amounts of stable manure, garden sand and Adco, and combinations of these additions. As in the pit experiment 10 per cent. (by weight) of Stable manure and garden sand and 1.5 per cent. of Adco were used. The pots were filled with 2 kilograms of the moistened material, well pressed in. The seagrass was found to be quite bulky, and did not yield to pressure. The pots were covered with bags which were kept moist throughout the experiment.

From time to time the samples in the pits and in the pots were examined. It was observed that the samples in the pots were maintained at a better moisture content and that the volume of material diminished considerably. At the end of the experiment, after being "rotted" for seven months the volume had shrunk to less than half of the original. In addition the fibre had become brittle and somewhat slimy—in fact the moist material closely resembled well rotted stable manure. In the pits the decomposition was slower owing to the difficulty of maintaining the moisture in the pervious soil. The shrinkage in volume was much less indicating that *the first requirement for satisfactory rotting is an abundance of moisture.*

The pit samples were prepared on August 23rd, 1928, and final samples taken March 20th, 1929, seven months later. The pot experiment was started on September 1st, 1928, and finalised on March 20th, 1929, after a period of nearly 7 months.

The samples were examined for Ash content, moisture content and availability of the organic matter. The results are summarised in Table 2.

TABLE 2.

Composition of seagrass before and after "rotting" treatments.

Treatm	Moisture per cent. (moist basis).	Ash per cent. dry matter	Organic matter per cent. dry matter.	Proportion organic matter humified per cent.
	%	%	%	%
Original Sample Stored dry...	7·7	52·3	47·7	67
Washed Sample Stored dry...	5·3	58·4	41·6	57
Pit Samp'es (Average) ...	35·5	65·6	34·4	64
Pot Samples (Average) ...	66·4	68·7	31 3	61

These results show that the organic matter of seagrass is in a readily humified condition as determined by the method devised by Robinson (Journal Agr. Sci. 15: 26-29, 1925) even before the artificial "rotting" process was started. The effect of the rotting led to a considerable loss of organic matter but this was necessary to bring about the proper physical condition of the material. Study of the individual samples showed that the effect of the Adco, stable manure and garden sand were negligible as far as any difference in rate of rotting was concerned.

Recommendations.—As a result of a study of the literature supplemented by the enquiries here reported certain recommendations may be made.

1. The moisture holding capacity of the seagrass is sufficient to warrant its use as a substitute for stable manure where transport does not render the cost prohibitive.

2. On account of the loose nature of the product as it comes from the beach, it is advisable to compost it for a period of about 6 months. During this period *the material must be kept in a saturated condition.*

3. As the fertilising constituents are very low it will be well to treat the seagrass with superphosphate when composting it. From twently to fifty pounds of superphosphate per ton may be used.

4. As this manure is designed *to increase the water holding capacity of light sandy soils* and not to supply fertilising ingredients it is necessary to add the usual dressings of artificials to the crops.

5. A mixture consisting of half stable manure and half seagrass composted for several months would be superior to the seagrass used alone.

6. Where seagrass it to be used systematically, it should be gathered from the beaches in late winter or early spring and composted. *It must be kept moist in the compost* until late autumn or early winter, when it should be applied to the soil and then *dug or ploughed in.*

7. As this manure is low in organic matter, relatively heavy dressings must be given. At least ten tons per acre should be used. It should be completely buried in the soil.

8. On account of the high content of calcium carbonate, this seagrass will be valuable on lime deficient soils. It will be at least as good as a dressing of agricultural lime.

In preparing this paper, free use has been made of the following literature:—

The Farmers' Handbook; New South Wales Leaflet No. 254, Board of Agriculture and Fisheries; H. J. Wheeler, Manures and Fertilisers; J. Alan Murray, Soils and Manures.

THE MANURING OF POTATO CROPS.

W. E. COLLINS,
Potato Inspector.

No other crop receives so much artificial fertiliser, or responds so well to it as the potato, which of all our agricultural plants is the most efficient convertor of artificial fertilisers into human food. In order that plants may develop and mature normally, ten essential food elements are necessary. If any one of these ten is absolutely lacking, no plant growth is possible. Fortunately the ordinary grower need not remember all ten, because experience has shown that the majority of these food ingredients are abundantly present in the average potato-growing soil. Of all the elements in the soil necessary for plant growth in this State, usually only three are not present in sufficient quantities for the production of large crops. These three are nitrogen, phosphorus and potash.

It is not the intention of the writer to go into the intricate physical, chemical and biological problems of plant nutrition, but to explain in as terse and simple language as possible how fertilisers may be used effectively and economically in the production of the potato.

A rational system of fertilising should be well grasped by every grower. Just as butter in the human diet cannot fulfil the same functions as meat,

so a plant food ingredient like nitrogen cannot possible be used by the plant for the same purposes as, say, phosphate or potash. Each plant food ingredient has an effect and duty of its own to perform in the development of the plant, and one plant food cannot do the work of another.

Cultural experiments and practical experience in the field have shown that the following are the specific effects or functions of the three main plant foods mentioned above.

NITROGEN.

The function of nitrogen is to promote the vegetative growth of the plant, and of giving the foliage a healthy green colour. It will be found that plenty of nitrogen, with sufficient moisture, makes the plant grow luxuriantly, giving it a big body, so to speak. The effect of deficiency is seen in a general stunting of the plants, and by the somewhat yellowish-green colour of the leaves. An excess produces a marked increase in the development of the foliage which is of a darker green than usual. Maturity is considerably delayed by the excessive use of nitrogen. Soils are more often deficient in nitrogen than in the other two elements, as it is constantly being removed from the soil in drainage water. Nitrogenous manures are, therefore, most important for the potato, and have the most immediate and direct effect. Experience has shown that under average conditions they are more likely to increase the yield of potatoes than either potash or phosphates. The commonest form of nitrogenous fertiliser used by the growers in this State is sulphate of ammonia. It is very soluble in water, but differs from the nitrate of soda, in that it is well absorbed by the soil constituents, and is not so readily leached out by rains. If a fair amount of rain is expected during the growing season, it is wise to apply only half the amount of ammonia in the furrow at planting time, reserving the other half for a top dressing, spreading this on as soon as the plants are discernable in the rows.

PHOSPHATES.

Two important functions are attributed to phosphates, viz., the stimulation of root development and the hastening of maturity.

Until quite recently the belief was current that the potato crops should receive a very generous application of phosphates, and trials conducted by the Potato Branch rather indicated this, but experiments conducted at other potato-growing centres have demonstrated that heavy phosphatic manuring may be responsible for only very small increases in yield. This may be due to the early maturity induced by phosphates and may counteract, to some extent, the beneficial effects of these manures.

The need for extra phosphates is not so general or so pronounced as that for nitrogen and potash, and in many districts, particularly the South-West, where the later element is almost a negligible quantity, much might be done in the use of a more balanced fertiliser.

For the potato crop superphosphate is generally accepted as being the most suitable phosphatic fertiliser, as it is readily available to the plant, and can be mixed with most other manures.

POTASH.

Potash is an important fertiliser for plants which produce an abundance of carbohydrates, such as starch and sugar, consequently the potato crop is dependent on a good supply of this element.

Experiments have proved that potash influences to a marked degree the health and growth of the tops. The most serious potato disease—Irish Blight—is favoured by heavy doses of nitrogenous manures, while potash tends to reduce its severity, and plants are said to be more resistant to fungoid and insect attacks when well fed with potash. Potatoes require a properly balanced relation between the nitrogen and potash to produce a healthy growth.

Although for most growers bulk of crop is of first consequence, due consideration should also be given to qualtiy. The ultimate criterion of quality is a cooking test, and there seems to be no doubt that the application of this element improves the cooking quality, whilst the absence of potash tends to give a sodden ill-flavoured potato.

Its effect on the crop is not very noticeable in the field, but a lack or abundance of potash is clearly shown by the weight and quality at the time of digging.

In general, potash goes to the making of better keeping, better eating and better seed potatoes. Various forms of potash manures are on the market, the principal one for use with the potato crop being sulphate of potash.

How are these fertilisers taken in by the plants? It may be explained here that the above compounds are termed "salts" by the chemist, and the three plant-food elements mentioned must, therefore, be present as salts to be available to plants. They are the actual fertilising ingredients in all fertilisers and manures.

It is a matter of common knowledge that plants cannot "swallow" solid particles of fertiliser, but that such particles must first of all be dissolved in water before the plants can make use of them. Normally, therefore, the soil moisture brings into solution the plant-food substances in the soil, and the plant roots then absorb or suck in this food-containing solution. A fertiliser becomes available to the plant only when it is soluble in the soil moisture. The soil moisture is never pure water, but always contains among other things carbonic acid, which weak acid increases the dissolving power of water. It is clear, too, from the above, that fertilisers can act as food in the soil only when the necessary moisture is present. Hence the great importance in this State in the summer with its customary long spells of dry weather to practise diligently the various moisture-saving devices.

Regarding what constitutes a profitable mixture to use, and the weight to be applied per acre, this critical point can only be determined by actual field experiments. The problem presented by each soil varies, and the grower must modify the quantities of fertilisers to suit his requirements. Manuring is subordinate to soil and climate: if these are unfavourable no skill in manuring will ensure a profitable yield. Further, manuring will not rectify the results of bad cultivation.

As a basis, the following mixture is likely to give satisfactory results:—

6 parts superphosphate.
3 parts sulphate of ammonia.
3 parts sulphate of potash.

Apply at the rate of 12 to 15 cwts. per acre, not forgetting, as mentioned previously, if a fair amount of rain is expected during the growing season to apply only half of the ammonia at time of planting, reserving the balance as a top-dressing.

BEEKEEPING NOTES.

H. WILLOUGHBY LANCE,
Apiculturist.

Last winter quite a number of colonies were lost through starvation. The spring was late, changeable and wet. With a normal spring many colonies would just have pulled through. But with the bad spring weather they consumed the last particle of food and quietly died out.

In the majority of cases with proper beekeeping this would not have occurred. Many beekeepers, in their greed for returns, rob the bees of their winter store instead of taking the surplus and leaving plenty of stores to cover emergencies.

The past season has varied very much in different districts. In Jarrah and Tuart and, in some cases, Marri districts, it has been exceptionally good, but in many places the reverse has been the case. When examining hives in March and April last I found very many with little or no honey therein, and at once warned the beekeeper to feed his colonies or he would not have any by the springtime.

There may be beekeepers who read these notes, who did not carefully examine their hives at the close of the summer and ascertain that they had plenty of winter stores. Any such I would advise to at once go through their hives, lifting each one to ascertain the weight, and if any are light, mark these, and then on the first warm, sunny day open them carefully, disturbing the bees as little as possible. Examine the outside combs and see how much honey there is. The amount required varies with the district. In most cases a fairly strong colony should have enough honey to fill at least two full-depth combs. A really strong colony three or four. It has to be remembered that bees consume a large amount of honey when brood-rearing. Very often a few warm spring days will start brood-rearing, then a spell of inclement weather sets in and the bees use up their last reserve of stores to feed the young larvae, and cannot get any more to replace it. Also much of the young brood gets chilled and dies. Then when honey weather sets in again there is delay in breeding until there is a fresh store in the larder both of honey and pollen.

If there is little or no honey, the bees should be fed at once with honey syrup or, failing this, sugar syrup. With an average thick honey, about two-parts of honey to one of water is a good proportion. See that all the honey is dissolved and mixed with water. Give this to the bees warm. There are many good feeders on the market, particulars of which can be obtained from any catalogue of bee goods. Failing one of these, a good home-made feeder is shown in Figure 1. The box is about 6in. x 4in. x 3½in. deep, a division is placed one inch from the end, the bottom only extends to this, thus having an entrance from the bottom, one inch wide. The top of the box consists of a piece of glass which slides in from the end, a space about ¼in. must be left between the top of the wood division and the glass. A piece of thin wood is now cut about ⅛in. smaller, each way, than the inside of the box, and a number of small holes bored therein. The box is filled with syrup, and a piece of wood acts as a float from which the bees feed, coming up through the inch space, extending over the division on to the float.

The advantages of this feeder is that it can be seen when it is empty, and can be refilled without removing from the hive. The inside may be filled with hot wax, swilled round and emptied out. This will make joints honey tight. If the matter is urgent and the beekeeper has not time to make the above, an effective feeder can be made by punching small holes in the top of a press top tin, which after filling is inverted on to a plate and placed

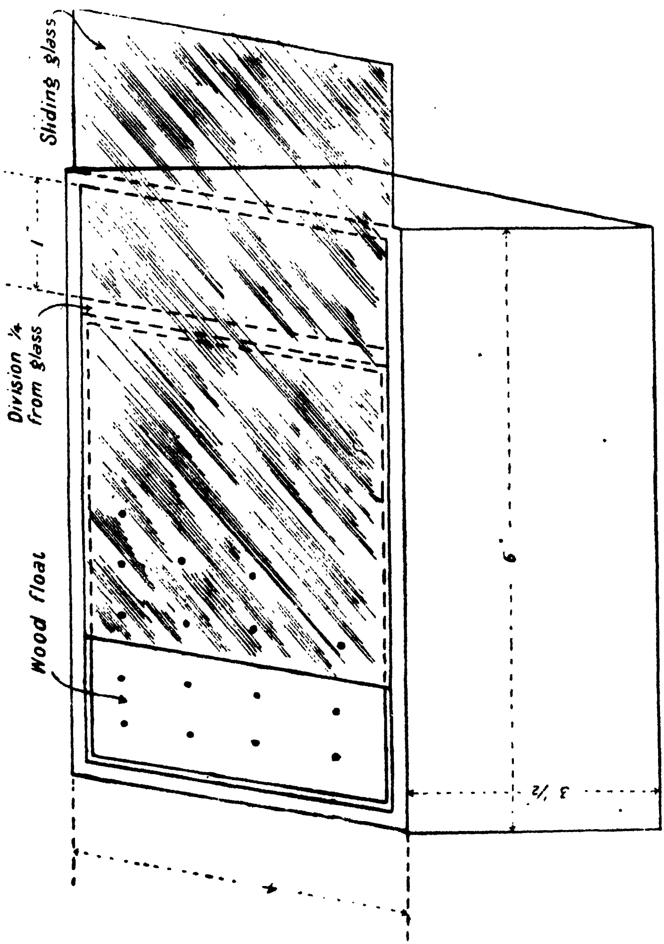


FIG. 1

on top of the frames inside a spare super box or a quilt made from some strong material can be put over the frames, a hole cut in the centre, and the inverted tin placed over the hole. This method has the advantage that during cold weather the brood nest is kept warmer than with the plate method. If any colonies are weak, only covering a few frames, entrances should be closed to two or three inches.

As soon as the spring really sets in all hives should be examined, as it is a most important time for beekeepers. Hives should be cleaned and faulty

ones replaced. (Now is the time to prepare hives for this spring examination. See notes in the *Journal* for June, 1928.) The brood nest should be examined, and if the queen is old and failing, the hive should be marked for re-queening at the earliest possible date. The amount of honey stores should be noted and, if necessary, colonies should be fed. If a colony is short of pollen, make a note of it, and later a hive may be found that can spare a comb of this most important food for the young bee, as no breeding can take place without it.

The first object of all beekeepers should be to build up strong colonies. The aim should be two 10-frame body boxes boiling over with young bees. I still find that the aim of many beekeepers is to make a show with a large number of hives, perhaps thinking that means a lot of honey No greater mistake can be made. A lot of hives frequently means no honey. Whereas a few strong hives means plenty of honey and less work. This is realised to such an extent in the United States of America and England that many beekeepers are using 12-frame hives with deeper frames. At the present stage of beekeeping here, I do not recommend this, except in special cases, with experienced beekeepers, but advise every beekeeper to aim at two full-depth bodies packed with bees. A good well-bred queen can easily keep these filled with brood during an average season. Cull your queens, and if you have any duds replace them with good stock. Who would be content with a hen that laid one egg per week when he can have one that will lay six or seven. Yet that is what many beekeepers have in the way of queens, those that lay only four or five hundred eggs per day instead of one or two thousand.

Re-Queening.—I am often asked how to re-queen, so I will give a few notes here on the matter. Of course, the first thing to do is to catch and kill the old queen, otherwise the young one will undoubtedly be killed. The usual process is to lift out the combs one by one and examine until the queen is found. It is handy to have a spare body near the hive so that the frames, as they are examined, may be replaced therein; otherwise while one comb is being examined the queen may pass from an unexamined comb to one that has been examined and replaced, and thus she will be missed. If all combs have been examined and the queen not found, carefully examine the floor board and sides of the hive, then re-examine the combs as they are replaced. If she cannot be found another method may be adopted. Remove the hive some 10 yards away in front of and with the entrance facing the old bee stand. Place an empty hive on old position.

Now place a white sheet or piece of newspaper in front of the old hive and an entrance guard over the entrance, open the hive, take out two combs of brood and examine for queen. If not found, shake half the bees on to the sheet, examine again, and if no queen place these two combs in new hive and fill up the space with empty combs on sheets of foundation. All flying bees will now return to the new queenless hive. Examine bees on sheet, and if queen is not found, take remaining combs and shake remaining bees off on to the sheet, examining bees after each shaking for the queen, then replace combs in old hive. If queen has not been found, close up the hive and leave until next day. In the meantime large numbers of bees will have sought their old stand and entered the new hive. As the number of bees in the old hive will now have been much reduced, it should not now be difficult to find the queen. This having been done, all the old combs and

bees may be transferred to the new hive; or the old hive can be replaced on its old stand and the two combs and bees in new hives transferred to it.

The queen having been disposed of, the usual method is to leave the hive queenless for a day, then taking the mailing cage in which the queen has been received, remove the cork or corks and also remove one frame from the centre of hive and wedge the cage between the remaining frames. In the course of a few days the bees in the cage and those outside will have eaten away the candy and the queen bee released. By this time she will have the scent of the hive, and will be accepted.

Other methods of introduction are:—

1. Smearing the queen with honey and placing her directly between the frames.
2. Wetting the queen with water and placing directly between the frames.

Both these methods depend upon the instinct of the bees to clean up the honey or water; by the time this is completed the queen and bees will have the same scent, and the queen will be accepted. Mr. Bartly of Tasmania claims that he has been successful with the water method in 98 per cent. of the introductions. His method is to wet the queen by placing her in a short glass tube partly filled with tepid water, shake the tube to and fro, pour off the water and allow the queen to walk down amongst the bees after giving a puff of smoke.

Yet another method which I had recommended to me, and which I have used with complete success, is the paper bag method. Take a small thin paper bag, such as is used for lollies, place the queen to be introduced therein, without any of her attendant bees, then catch 10 or a dozen bees from the hive and place them in the bag with her. Although the queen is strange to them, they will be so busy trying to get out that they will not take any notice of her, and in the meantime they will all get the same scent. Remove one frame and place the bag in the hive between the frames, and in the course of a few hours the queen will have been released and accepted. The advantage of this method is that there is no need to leave the hive queenless for a day. I have opened a hive, destroyed the queen, and introduced a new one in a paper bag straight away with considerable success.

Whatever method is adopted, the hive should not be disturbed for about three days, after which time it should be opened to see that the queen is "O.K."

Pollen.—As has already been mentioned, apart from honey, the future generation of the hive depends upon a supply of pollen. Pollen is the reproductive substance of flowers, which is transferred from the male to the female portion of the flower or from the male flower to the female flower for the reproduction of species. Nature has provided various methods for this transfer. Amongst these are flying insects, of which bees are the principal. Pollen is the vital substance of the flower in concentrated form, is highly nitrogenous, and contains necessary vitamins. Nature is always prolific, and provides more than is necessary for reproduction purposes. Bees as they visit flower after flower carry the pollen and fertilise the stamens. In doing this they take a toll for their service, and carry some of the surplus pollen away to their hives to make food for their young larvae. When breeding is taking place the nurse bees consume honey and pollen and convert this into chyle food, which is deposited in the larvae cells.

If there is a shortage of pollen, therefore, breeding suffers, and the colonies do not build up, or may dwindle if insufficient bees are not bred to make up for wastage. The importance, therefore, of a pollen substitute has been realised by beekeepers for many years. From experiments that have been made it is evident that the question must be studied scientifically. Recently the Beekeepers' Association of Victoria approached the Commonwealth Committee of Scientific Research with a request that investigation should be made to find a pollen substitute, but the request was turned down.

The question is being studied in other places, and the following particulars of experiments at the College of Agriculture and Forestry, Brno, Czechoslovakia, will be of interest to beekeepers. As far back as 1871 Fischer propounded the theory that the pharyngeal gland was the source of the larval food. Stephen Soudek at the above College has recently been making microscopical studies of this gland, and his experiments therewith confirm Fischer's conception.

He fed very young bees, which had just emerged from the cells, with different foods and compared their action on the pharyngeal gland. He found that these glands only developed with those bees whose food had contained pollen. In cases where the food only contained honey or sugar, these glands shrunk up, proving the real importance of pollen. After this he tried many substitutes, amongst which were wheat flour, wheat bran, starch, ground beans, olive seed cake, linseed cake, peanuts case, ground fish, ground meat, etc. All of these did not bring the pharyngeal gland to development. Only in two cases did the glands become fully turgescent. These were when the young bees were fed with fresh egg albumen stirred into sugar syrup or with dried yeast. He, therefore, assumes that these substances can replace pollen, but states that many further experiments will have to be made before any pronouncement can be made.

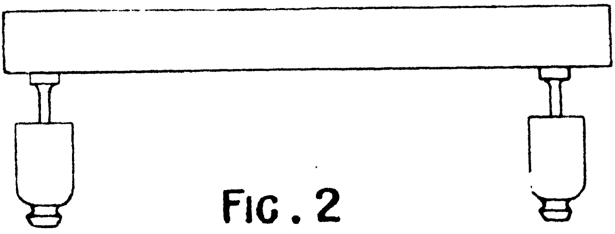


FIG. 2

He, however, advises beekeepers that as we know of no definite pollen substitute they should, when there is a lack of pollen, feed the bees with the fresh white of an egg stirred into sugar syrup. Pine pollen collected the previous season did not provoke any development of the gland. Bees feed on the yoke of an egg, ground meat and ground fish died in a few days. It is surprising the variety of substances bees will carry in to their hive when there is a shortage of pollen. They realise the need for some such substance, and in their extremity have been known to work on wheat shorts fed to cows, fine sawdust, and even coal dust.

Old pollen that has been stored in the comb for a long time seems to loose its goodness, and bees always prefer the fresh gathered substance.

If there is old hard pollen in the hive, and yet no breeding taking place at the usual time, I would recomend the removal of this pollen by scraping down the comb with a sharp tool almost to the midrib, then pound the pollen—if particles of comb are mixed with it, it will not matter—and stir in with the fresh white of an egg mixed with sugar syrup.

If any method of feeding pollen, or pollen substitute is adopted, care must be taken to feed slowly and to keep up the supply until natural pollen comes in.

Ants and Stands.—In some districts ants are a great pest, not only attacking bees that alight on the ground, but climbing the hive and entering therein. The small sugar ants frequently making their nests between the quilt (where these are used) and the cover. That is one reason why I do not recommend the use of quilts. It is far better to have a bee space of ¼in. between the tops of frames and the cover.

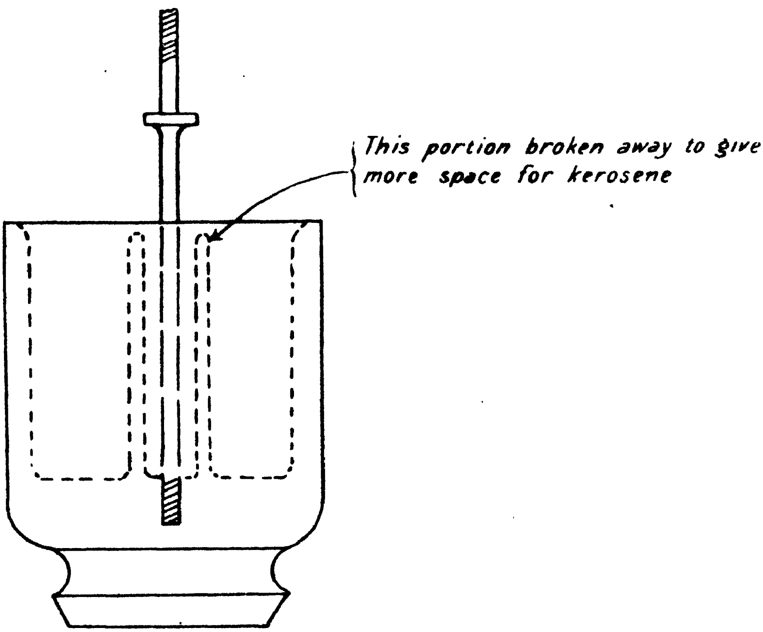


FIG. 3

The larger types of ants, particularly the Meat Ant (*Iridomyrmen detectus*) attack the hives and cause large numbers of bees to stay home to defend the entrance.

If nests can be located, bi-sulphide of carbon, sheep dip, or cyanogas are good substances for destroying same. A hole, several inches deep, according to size of nest should be made in the centre, and a quantity of one of the above substances put therein, and the hole covered up. If the nests cannot be located or are too numerous, a good ant-proof stand may

be made from old telegraph insulators, as shown in Figure 2. Four pieces of 3 x 2 inches may be nailed together to make an oblong the size of hive, and four inverted insulators let in to the corners. These should be of the hollow type, and the inside collar of china broken away (see Figure 3). This space will now form a cup, which is filled with kerosene.

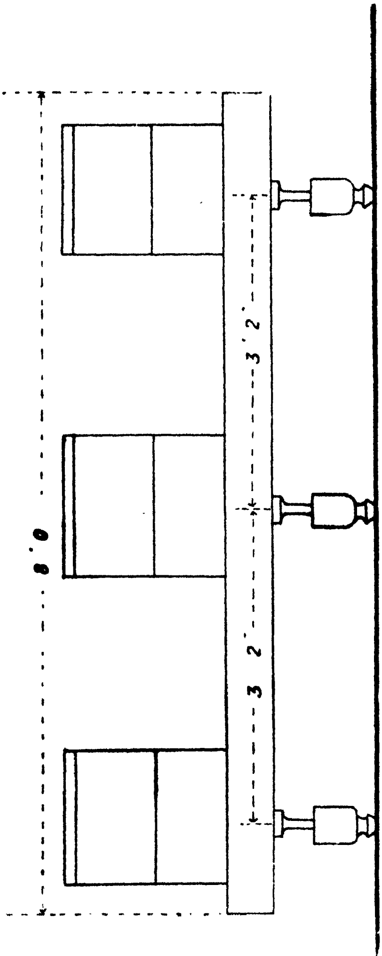


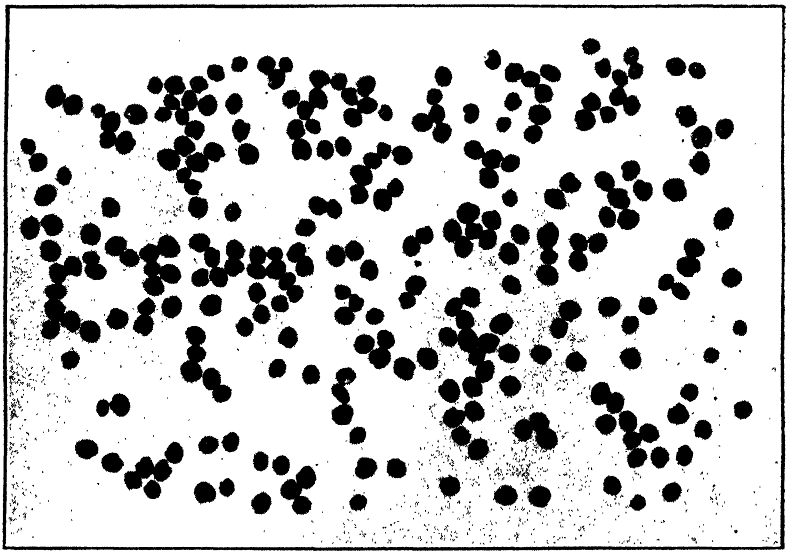
FIG. 4

If there are a large number of hives, stands to carry three hives are very convenient, and only six insulators need be used instead of 12. If the stand is made eight feet long, this will allow spaces between the hives for placing supers, etc., when manipulating. The insulator legs should be placed directly under the hives, and as these are frequently screwed on to the metal shanks, they can be screwed up or down to adjust the stand to a level. (See Figure 4.)

SUBTERRANEAN CLOVER SEED AND ITS IMPURITIES, WITH A COMPARISON BETWEEN MACHINE CLEANED SEED AND SEED IN THE BURR.

H. G. ELLIOTT, Dip.Agr.,
Assistant Plant Pathologist.

Subterranean Clover is the principal leguminous pasture plant of the South-Western portion of this State. It is the most important factor in the development and maintenance of that agricultural area, and consequently special attention should be given to the buying and using of good seed. This need was never more pronounced than it is at the present time.



No. 1.—A clean well-graded sample, with a purity of 98 per cent. and no weed seeds. Compare this with No. 2.

When buying the seed the farmer should take into consideration the following points:—

1. Quality.
2. Purity.
3. Germination.

1. *Quality.*—Subterranean Clover seed of good quality is large, about one-eighth of an inch in width, dark purplish to nearly black in colour, dull or slightly shining, averaging 114,800 seeds per lb., and is practically free from weed seeds and other impurities.

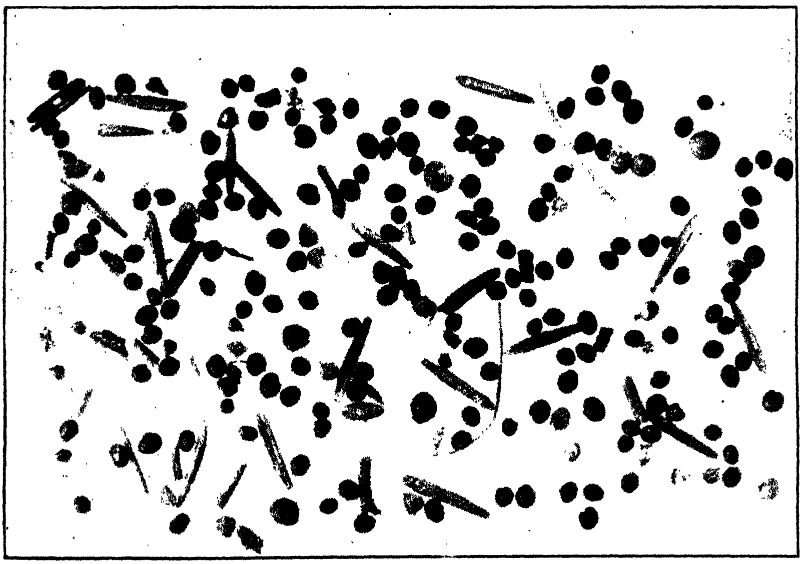
Among samples will be found some that are practically free from weed seeds and dirt, germinating 85-93 per cent. (see Fig. 1), and others which

contain dirt and weed seeds, including species that are not desirable. (See Fig. 2).

These extremes can be represented by the analyses of two samples, which were actually submitted for test.

Sample No.	Price per 10lbs. at 2s. per lb.	Percentage of Weed Seeds.	Percentage of Dirt, Sticks, Stones, etc.	Percentage of Sub. Clover Seed.	Percentage of Sub. Clover Seed that germinated.	No. of Weeds per lb.	Relative Value per 10lbs. of germinable Sub. Clover Seed.
							£ s. d.
1	£1	Trace	0·6	99·4	92·5	90	1 0 0
2	£1	17·8	14·0	68·2	70·0	9,888	0 10 11

In order to sow an equal amount of good germinable seed from each sample, it would be necessary to sow 9 lbs. of sample No. 2 to give the same result as 5 lbs. of sample No. 1. Every time 450 weed seeds are sown with No. 1, 88,992 weed seeds would be sown with the other sample.



No. 2.—A dirty, weed-infested sample, seeds of uneven size. Purity 78 per cent., weed seeds 16 per cent. This sample was sold for the same price as No. 1.

From the above figures a farmer can see what a difference in real value as compared with quoted prices, the quality of the seed makes.

2. *Purity.*—The test for purity consists in determining the percentage by weight of the sample which is true to name; the percentage of inert matter, such as broken or insect-damaged seeds, earthy matter and impurities of vegetable or animal origin, and the percentage of foreign seeds, *i.e.*, weed and other seeds, are incidentally determined.

Freedom from Weeds.—The farmer, when planting his Subterranean Clover, does not want to sow with it large quantities of foreign seeds (some of which may be bad weeds, such as dodder, thistles, docks and sorrel), but requires as near as possible seed which is free from weeds.

The occurrence of weed seeds in samples is due to the weedy condition of the Subterranean Clover fields, these weed seeds being harvested with the burr. These seeds will appear in the cleaned Subterranean Clover seed in quantities proportional to their abundance in the field, and inversely proportional to the extent to which the clover seed is cleaned. Thus a long list of foreign seeds is liable to appear in commercial samples. A first-class sample of seed should contain none or only a few weed seeds.

List of Foreign Seeds which have been found in Subterranean Clover Seed and Burr.

Legumes—*Medicago denticulata*—Burr Medic.
Medicago lupulina—Black Medic.
Trifolium cernuum—Drooping Flowered Clover.
Trifolium glomeratum—Cluster Clover.
Trifolium procumbens—Hop Clover.
Trifolium tomentosum—Woolly Clover.

Grasses—*Alopecurus pratense*—Foxtail.
Avena sativa—Oats.
Bromus maximus—Large Brome.
Bromus mollis—Soft Brome.
Bromus sterilis—Sterile Brome.
Cynodon dactylon—Couch Grass.
Festuca Myuros—Silvery Grass.
Hordeum murinum—Barley Grass.
Hordeum sativum—Barley.
Lolium perenne—Rye Grass.
Lolium temulentum—Drake.
Paspalum dilatatum—Paspalum.
Setaria spp.—Millets.
Sorghum sudanense—Sudan Grass.
Stipa spp.—Native Spear or Corkscrew Grasses.

Other Weeds.—*Bartsia viscosa*—Yellow Weed.
Brassica spp.—Mustards.
Cuscuta spp.—Dodder.
Cryptostemma calendulaceum—Cape Weed.
Erodium spp.—Crowfoot.
Hypochaeris glabra—Catsear.
Hypochaeris radicata—Flatweed.
Inula graveolens—Stinkwort.
Plantago lanceolata—Rib Grass.
Plantago major—Large Plantain.
Romulea rosea—Guildford Grass.

Other Weeds (*contd.*)—*Rumex acetosella*—Sorrel.
Rumex spp.—Docks.
Sonchus oleracea—Milk Thistle.
Tunica prolifera—Wild Pink.
Native Rush Seeds.

Of this list the most serious are:—
Bartsia viscosa—Yellow Weed.
Cuscuta spp.—Dodder.
Inula graveolens—Stinkwort.
Romulea rosea—Guildford Grass.
Rumex spp.—Docks and Sorrel.
Stipa spp.—Spear or Corkscrew Grasses.

In sheep country *Bromus, Stipa* and *Medicago denticulata,* particularly, should be avoided since their seeds are detrimental in wool.

Any Subterranean Clover seed samples containing dodder should not be used or bought, for dodder is a parasitic plant, which lives at the expense of the growing clover, and will quickly ruin the pasture. The seed of dodder is more easily introduced by sowing the burr, for well milled and graded Subterranean Clover seed should always be free from it.

3. *Germination.*—The germination test is not less important than the test for purity, for the farmer should avoid buying seed of low vitality, a condition which can only be determined by the germination test. Some samples of Subterranean Clover give a high germination, others give only a low one, while others are intermediate.

As it is possible to obtain high grade seed, a farmer should not be willing to take the risk of buying seed the germinating quality of which he does not know, nor be satisfied with only a fair-grade seed. Partial failure of fields is often due to the reason that much of the seed planted does not germinate.

The test consists of determining, by number, the percentage of germinable seed, of "hard seeds," and of dead seeds.

Hard Seeds.—In testing Subterranean Clover seeds, indeed all clover seeds, for germination, there is always found a percentage of "hard" seeds which do not germinate in the usual time. These seeds do not for the time being absorb water, and consequently do not germinate. In Subterranean Clover the percentage of hard seeds varies. In, for instance, machine-cleaned seed, the hard seeds vary from 2-70 per cent., whereas with burr the percentage is much higher, ranging from 54-92 per cent.

Under field conditions hard seeds remain dormant, but they may, after a time, germinate; if they germinated the first year they would, in all probability, only result in weak plants, being shaded and overcrowded by their earlier, more vigorous neighbours.

Hard seeds have some advantages, and are useful at times in the burr. When early rains germinate the germinable seeds, and dry conditions following kill off the young seedlings, the farmer has the hard seeds to rely on, as they are not affected by the early rains, and a percentage of them will germinate later on, promoting a fair stand.

Another advantage of hard seeds is that, when the conditions in established pastures were unfavourable for the plants to reach maturity (only a small number of seeds maturing, and not re-seeding the fields sufficiently), in the following year a percentage of hard seeds may germinate, thus assisting in producing a fair stand of clover.

Hard seeds keep their vitality for a number of years, but when the seed coat becomes sufficiently permeable for water to penetrate they will germinate.

It is rather difficult to determine the value of "hard seeds," but there are two courses open to follow:—

1. To regard the hard seeds as useless, merely noting their presence.
2. To assume a portion of them, say one-third, will germinate in a reasonable time.

Authorities differ as to which is the better of the two ways, but it would probably be safer to leave them out of the calculation altogether.

Results of purity and germination tests on burr and machine-cleaned Subterranean Clover seed from the year 1923 are given in the following tables:

TABLE 1.—SUBTERRANEAN CLOVER BURR.

Year.	No. of Samples.	Purity.	Germination.	Hard Seeds.	Weed Seeds.
		%	%	%	%
1923–4 Average ...	5	14·6	22·9	74·6	0·4
Range ...	...	6·0—19·3	16·0—38·5	57·5—84·0	Trace—2·0
1924–5 Average ...	7	9·9	10·7	81·8	0·9
Range ...	...	1·6—24·3	3·0—19·5	72·0—91·3	Trace—3·5
1925–6 Average ...	7	13·5	44·7	54·7	0·3
Range ...	...	9·9—23·4	43·5—46·0	54·0—55·5	0·03—0·5
1923–6 Average ...	19	12·6	27·5	70·9	0·54
Range ...	...	1·6—24·3	3·0—46·0	54·0—91·3	Trace—3·5

NOTE.—Since 1926 the number of samples of Burr tested are not sufficient to warrant giving any definite averages.

TABLE 2.—SUBTERRANEAN CLOVER—CLEANED SEEDS.

Year.	No. of Samples.	Purity.	Germination.	Hard Seeds.	Weed Seeds.
		%	%	%	%
1923–4 Average ...	3	93·8	78·1	19·3	Trace
Range ...	...	93·0—96·0	69·0—86·5	11·7—28·0	0—Trace
1924–5 Average ...	4	96·8	62·6	27·3	0·25
Range ...	...	94·3—99·5	37·5—79·5	14·0—61·5	0—0·7
1925–6 Average ...	8	95·5	75·03	23·1	Trace
Range ...	...	84·0—99·4	45·0—89·0	11·0—52·5	0—Trace
1926–7 Average ...	12	93·5	59·0	39·2	0·25
Range ...	...	82·8—98·0	30·5—80·0	14·5—69·5	0—1·2
1927–8 Average ...	11	92·6	71·9	24·3	0·85
Range ...	...	88·5—98·2	47·0—91·0	2·0—53·0	0—3·0
1928–9 Average ...	22	90·2	62·1	33·6	1·63
Range ...	...	68·0—99·0	32·0—92·5	4·5—51·5	0—17·8
1923–9 Average ...	60	92·6	66·17	30·3	0·82
Range ...	...	68·0—99·5	30·5—92·5	2·0—69·5	0—17·8

The above tables show that machine-cleaned seed is the best, the purity and germination being higher, and the percentage of weeds and hard seeds lower.

Taking the cost of these two in 1923, burr was sold on the average at 10s. per bag of about 35-40 lbs. weight, whereas the machine-cleaned seed was sold at 6s. 6d. per lb. From one of each of the best samples examined in that season, the burr gave 12.5 per cent. purity and 22 per cent. germination, whereas the cleaned seed gave 95 per cent. purity and 78 per cent. germination. A bag of burr weighing 40 lbs. and giving 12.5 per cent. purity would result in 5 lbs. of pure seed, and 20 lbs. of machine-cleaned seed of 95 per cent. purity would give 19 lbs. pure seed.

The cost of 1 lb. of the burr seed would be 2s. and that of the cleaned seed 6s. 10d., but the burr seed gave 22 per cent. germination and the cleaned seed 78 per cent. germination, so that the final actual cost of the respective samples per lb. of pure cleaned germinable seed was 9s. 1d. in the case of the burr, and 8s. 9d. with the machine-cleaned seed.

From these figures it will be seen that the cleaned seed at 6s. 6d. per lb. was more economical than burr at 10s. per bag. This is neglecting the cost of transport, which adds to the cost of the burr.

In 1923 the farmer did not have much choice, as there were only limited supplies of the cleaned seed available. This cleaned seed had to be imported from the Eastern States where there were machines capable of cleaning the seed. Owing to these difficulties the main areas were sown with Subterranean Clover burr.

This is not the position at the present time, as there are many machines operating in this State, and now cleaned seed can be obtained for about 2s. 3d. per lb., but there are still people who will buy the burr which is sold at about 6s. 6d. per bag.

It is much more economical and beneficial to sow the cleaned seed, for in every case the cleaned seed will give a higher percentage of purity and germination, and a lower percentage of hard seeds and weed seeds.

Generally speaking the farmer does not find it very difficult to obtain his Subterranean Clover seed, but since 1923 a large number of commercial samples have been examined, comprising some that were good, others bad, and still others worthless. Some contained weed seed impurities in much greater proportions than should have been the case.

Profitable growing of Subterranean Clover depends largely on the use of good seed and the non-introduction of undesirable plants.

In conclusion, good Subterranean Clover seed should have a reasonable proportion of mature seed of at least average size, with only a small proportion of impurities, a minimum amount of weed seeds and a good capacity for germination with a minimum percentage of hard and dead seeds.

Some of the principal causes of Subterranean Clover seed being poor are want of proper cleaning, careless handling, and the harvesting of the seed from dirty, weed-infested pastures.

The following points require special attention when buying seeds:—

1. Buy from reliable seedsmen, and, if possible, on tested samples, or obtain samples and have them tested. Firms will give a percentage statement as to purity, germination and weed seeds.

2. Avoid buying cheap seeds. Always demand the best.

HORTICULTURAL NOTES.

GEO. W. WICKENS,
Superintendent of Horticulture.

SEASONABLE WORK FOR JULY, AUGUST, AND SEPTEMBER, 1929.

July.

July is usually one of the months of the year in the fruitgrowers' calendar when outdoor work is carried on with considerable discomfort, because whether it comprises pruning, spraying, or planting, the rainfall generally renders the job an unpleasant one and visions of rheumatism incurred through remaining in wet clothes has a tendency to damp enthusiasm even in the younger generation of fruit producers. But at any rate so far as pruning is concerned unpleasant weather conditions must not delay the work or spring will arrive (and with it the duties pertaining to that period of the year) before the operations belonging to winter have been completed, and there is nothing so disorganising as the endeavour to catch up in a later time of the year with work which should have been completed earlier in the season.

There are many text-books dealing with pruning, and I shall not endeavour in these notes to cover a subject which, if fully dealt with, would fill a fair-sized volume, but I would remind growers that they can obtain advice and practical demonstrations from the orchard supervisors who traverse their districts, and the information contained in text books becomes much more easily understood after seeing the work performed. I know there are many growers who have been in the industry for a fair portion of a lifetime, and these, from experience gained by experiment and observation, have evolved a system of winter pruning suited to the requirements of their trees. Some of the systems follow orthodox procedure; some vary from it considerably, but a system which gives a maximum quantity of high quality fruit and assists the trees to maintain a sound physical condition is quite a good system, whether it be orthodox or otherwise. The growers referred to are not likely to alter their methods, but there are many newcomers now giving attention to fruitgrowing who have not even a rudimentary knowledge of the principles underlying the practice of pruning, and these are strongly advised to seek instruction either from the orchard supervisors or neighbours who have proved successful. Many years of wasted effort and expensive mistakes can be guarded against by starting out on right lines.

Neither spraying nor planting can be efficiently carried out during wet weather, the former because the spray mixture will not adhere to the trees, and the latter because wet, sticky soil is not in a fit condition to receive the trees. These two operations must then, of necessity, be postponed if weather conditions in July are unsuitable.

Fruit-fly traps in citrus orchards need attention at short intervals throughout July, particularly open traps which are liable to become flooded.

August.

Pruning should be completed by the end of August, and the same advice applies to planting deciduous trees. Citrus trees should not be planted until September unless in specially well-drained situations. Where old apple and pear trees require working over to other varieties, the necessary scions should be secured early in this month from trees of proved bearing habit, and buried in soil in a cool place to retard bud bursting.

Growers whose orchards are infested with San José Scale are reminded that they are obliged to spray at least once during winter months, and where the pest is prevalent are advised to spray twice. Instructions under the "Plant Diseases Act" have been issued to this effect and growers failing to comply render themselves liable to prosecution and a minimum fine of £5 with a maximum of £100. Fortunately, most orchardists are aware of the danger of allowing their orchards to remain unsprayed, and there is not often the need to invoke the power of the law to compel them to spray, but it certainly is significant during the last few years to note that growers whose fruit has been rejected from export on account of infestation with San José Scale have now considerably less scale than formerly, and it would appear that, though the spraying has been done annually, more care has been exercised in the application since losses have been experienced through rejections. Spray thoroughly with the right materials or the work done is merely a waste of time and money.

Orange aphis will appear this month and where the insects are sufficiently numerous to damage the young shoots they should be sprayed with Black Leaf 40 and soap, using 1lb. Black Leaf 40 and 3lbs. soap in 80 gallons of water.

Carefully examine loquats for traces of fruit-fly and destroy these, with any oranges and mandarins found to be infested.

Continue trapping for fruit-flies and examine, cleanse and replenish traps frequently.

September.

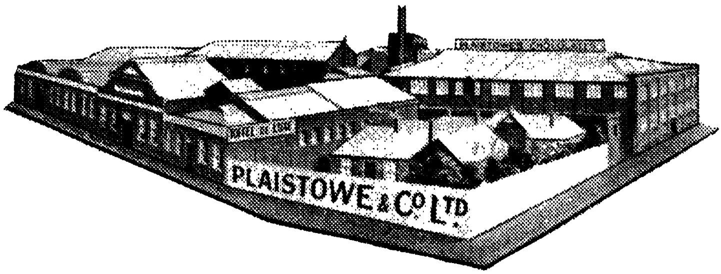
Ploughing, hoeing and cultivating are major operations during September.

Citrus tree planting must be finished this month. Graft over all obsolete varieties of apple and pear trees with varieties which will pay, but only graft such trees as have sound healthy stocks. An unthrifty stock will never produce a good tree. Use the strap graft and, if not familiar with it, ask the orchard supervisor in the district for a demonstration.

Continue treatment for Orange Aphis.

Trap and bait regularly for fruit-fly.

Pay special attention to Pear Scab. Attention to the soil, the trees, pests and diseases makes September a month of strenuous endeavour, but there is great joy in springtime in watching fruit form and grow as the result of duties faithfully performed.



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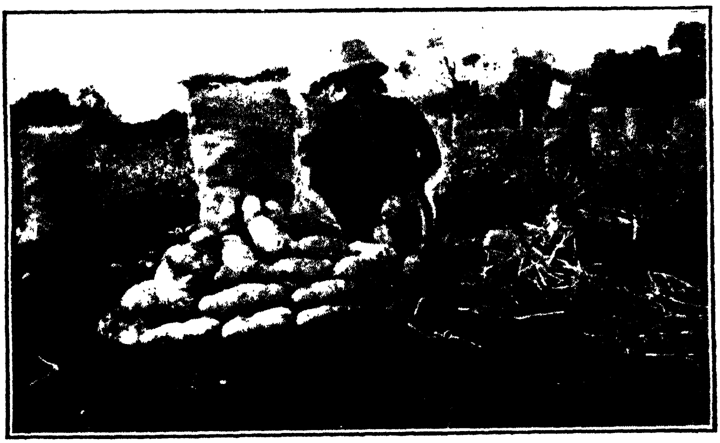
"POTATO CHIPS."

G. N. LOWE,
Senior Potato Inspector.

What one pair of hands can accomplish.

It is quite unusual for the writer in his travels amongst the potato producers to find a "one man" effort in the way of persuading the "wily" tuber to do its best, except on very small plots.

Just what can be done by sheer application to the job in hand, thoroughness, and perseverance is demonstrated most markedly this season by Mr. Fred H. Tonkin, of Young's Siding.



Mr. Fred Tonkin and 87 of his "little potatoes" which filled a bag. These will be on view at the next Royal Show in the exhibit of the Potato Branch.

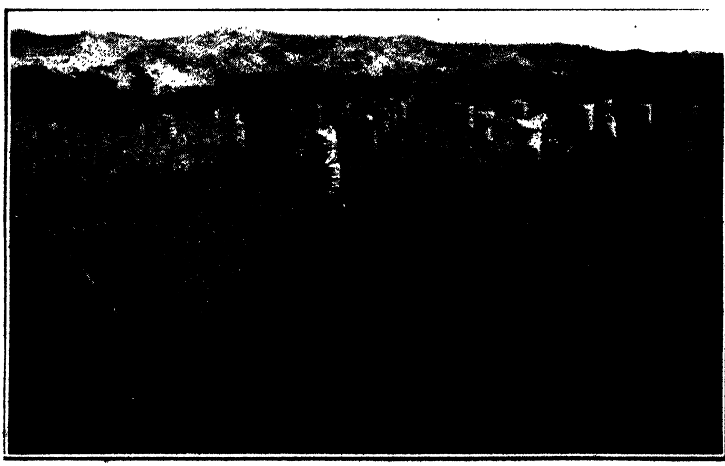
Mr. Tonkin, who is a son of the Secretary of the Certified Seed Potato Growers' Association of that centre, comes well within the "lightweight" division, but what he lacks in brawn he certainly makes up in "stickability" and energy.

Mr. Tonkin believes in thoroughness first and last, and the result from his single handed effort in working four acres of peat swamp, racking, grading, and dipping the necessary seed, carting and handling twice the manure, planting the area, harrowing, cultivating, and hand hoeing that area, and taking off something over 50 tons of potatoes is in itself something of which to be proud. The mere keeping down of weeds in this wonderfully fertile class of soil is no lazy man's job, and would induce a distinct feeling of shyness ("work shyness") in the average man.

Mr. Tonkin is moreover a thorough believer in "root selection" for the provision of his seed, and is one of the few growers in the State who are consistently practising this ideal method of maintaining and increasing their yield.

Portion of Mr. Fred. Tonkin's crop which yielded at the rate of 19 tons per acre.

As an indication of what is thought of this grower's certified seed, it is interesting to record that practically the whole of his yield was booked up weeks before the crop was dug. One well known South-Western grower actually ordered 15 tons before the crop was planted.



Nine tons of potatoes on ½ an acre grown by Mr. Fred. Tonkin.

The opportunity offering to careful Great Southern growers.

Now that the fact that certified seed from the Albany-Denmark area is fast retrieving what was becoming a very serious position from a standpoint of profitable potato production, more particularly in the South-West, it is becoming more and more apparent that certain of our best growers in the former area can devote the whole of their energies to growing certified seed. The only portion of their crop which need be marketed in the ordinary way is that which for some reason or other is not fit for certification, amounting perhaps to 10 per cent. and probably less, this being, of course, governed by the condition of the crop.

With an assured market in the South-West for seed for winter planting at an advance of from £4 to £5 per ton in every season, over 50 per cent. of which in a good crop is clear profit, the particular grower has an excellent opportunity.

On present indications, due to Mosaic ("Crinkly Leaf") appearing more or less badly in crops grown from certified seed from the Great Southern, after two plantings in the South-West, there will be a regular demand for the former seed each season.

When it is known that approximately 20,000 bags of seed are required for the South-Western winter crop under the present acreage sown, and that to date not more than 5,000 bags of certified seed have been available in any one season (with the demand greatly increasing), the prospect for the careful grower in the Albany district, who will concentrate on seed production, looks rosy indeed.

Reduction in Importations.

It is very satisfactory to be able to record the steady decline in the quantity of potatoes imported each year for a period, into this State.

The following figures taken at the end of March for the last three years will give a good indication of the saving which is occurring to the State and incidentally to the grower:—

Year.	Tons.	Value. £
1927	335	3,863
1928	284	1,725
1929	96	1,114

Whilst importations in any year to the end of March only represent a small portion of the year's total, the proportional reduction has been maintained. Undoubtedly the use and influence of certified seed is largely responsible for this pleasing state of affairs.

Sprouted v. Unsprouted Seed.

Not often does it occur that the relative merits of sprouted as against unsprouted seed can be so nicely compared as in the next illustration.

This photograph was taken on the property of Mr. J. C. Blake, at Young's Siding, and he explained that in order to finish off the "land" he found it necessary, owing to a shortage of sprouted seed, to use some of the same strain which was not nearly so forward.

The difference in germination is apparent, and from appearances at the time the yield would be five to six tons to the acre in favour of the sprouted seed.

Enquiries for Seed.

More often than not when letters reach this office from growers asking information as to where supplies of seed may be obtained the very important detail as to the proposed time of planting is not mentioned. This omission makes it very difficult for the best information to be given in reply. It will greatly assist if this be mentioned in each instance.

Sprouted v. Unsprouted Seed. Showing unsprouted seed results in the centre.

A probable cause of bad germination.

During this last summer crop numerous instances came under notice of bad germination with cut seed in portions of a planted area, other portions being normal.

The soil moisture upon investigation appeared, of course, to have a very definite influence, but it would seem that the application of the fertiliser direct on to the cut surface of the "set" is an important factor to be considered.

Where no care had been exercised in placing the "set" to see that the skin side was not exposed to the fertiliser the resultant damage was often so great as to practically wipe out the crop. Soil temperatures are probable another influence under summer conditions, but it does certainly appear that that little lack of extra care in planting is causing much loss.

A very simple test of what is likely to occur can be made by dusting a few freshly cut sets with fertiliser and allowing them to stand for even a few hours. The loss of sap begins almost at once, and eventually the set practically collapses. Under field conditions a modification of this occurs, the severity or otherwise doubtless being controlled by soil moisture.

It is proposed to shortly carry out an experiment in order to learn something definite in this direction both for winter and summer planting.

In the meantime it is wise to either press the set into the mould away from direct contact with the fertiliser or alternatively cover the seed with a very narrow sod and apply the fertiliser next it.

Record Yields.

When last year, at Young's Siding, returns of up to 21 tons per acre in portions of crops were obtained, it seemed as though the limit had been reached.

Mr. Kurt Martin stands to after digging portion of his crop which yielded at the rate of 23 tons 7cwt. per acre.

This season, however, the wonderful yield of 23 tons 7 cwt. per acre was harvested by Mr. Kurt Martin on a portion of his land. From two acres of the same class of soil Mr. Martin took 40 tons of excellent tubers which is probably nearing a world's record for two acres.

NUT GRASS

(*Cyperus rotundus*, Linn.).

C. A. GARDNER, Government Botanist.

Nut grass is a common weed in the South-West inhabiting damp situations. It is particularly common on low flat soil which is wet in winter, and along the shallow banks of creeks. Where undisturbed in a suitable environment it may become an aggressive weed, its habit of spreading by means of its underground rooting stems with tubers or "nuts," together with its capability of frequent seeding, making it very formidable.

Each tuber or nut is capable of producing a new plant, hence cultivation helps to spread the plant instead of destroying it. The plant appears, however, to spread itself more by seeding than by spreading in the soil. Nut grass is particularly tenacious. If covered up to three feet with soil it will re-appear and flourish. It has been known to penetrate through two inches of blue-metal asphalt which contained no visible fissure, and in New South Wales the roots were found 30 feet below the surface during well-sinking operations. The rhizomes are stated to perforate and completely riddle potato and dahlia tubers.

Nut grass is not a true grass, but belongs to the Sedge family. The "nuts" are tubers, and are said to yield an essential oil which is used by the natives of Upper India for perfuming clothes. They are rich in starch, and are eaten by our aborigines in some localities. The leaves of nut grass are bright green and rather harsh. The flower stalks are triangular and solid, and it may thus be distinguished from true grasses, together with the fact that the leaf sheaths are not split to the base as in true grasses.

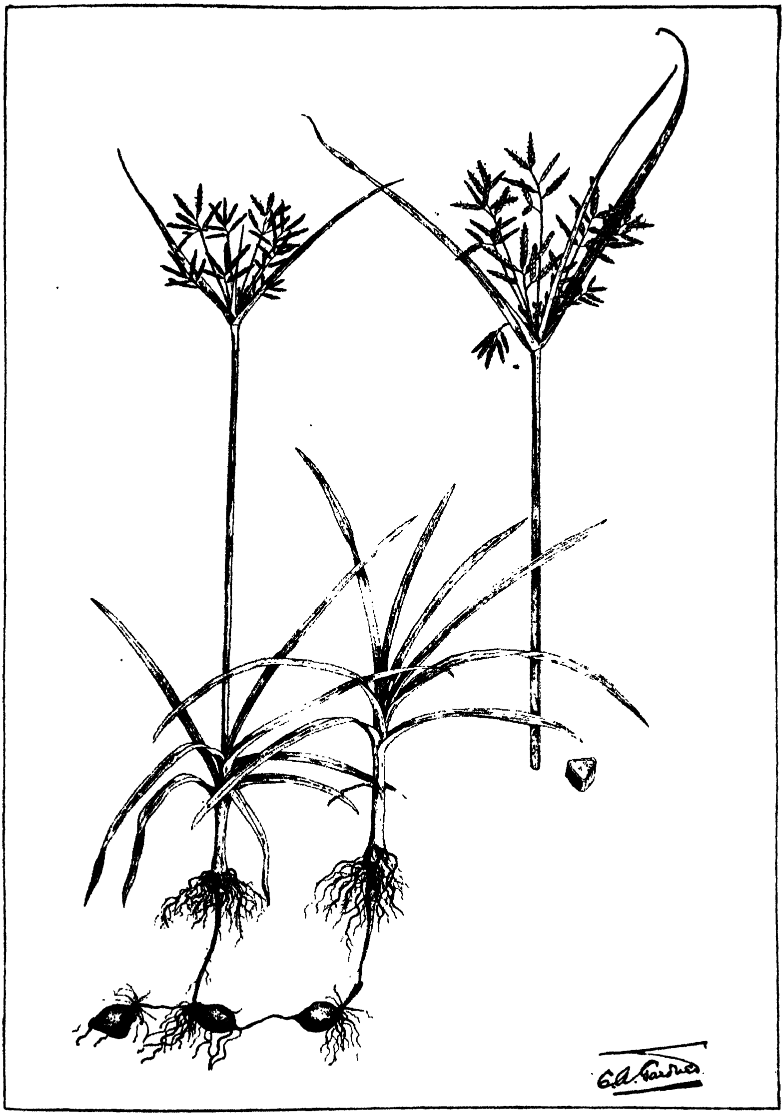
Horses and cattle eat the leaves and pigs are said to be remarkably fond of the tubers, but pigs are not to be considered of much value as eradicating agents, since they do not eat out the patches completely, and probably serve to encourage the plant by stirring up the soil.

Three methods of eradication for nut grass may be recommended, depending upon the circumstances of its occurrence. Where the weed is not plentiful it may be exterminated by persistent hoeing, extending over long periods, or by forking the "nuts" out of the ground. Poison (Arsenite of Soda) may be used, but the applications require to be frequent. Poisoning should only be resorted to on waste lands or on pathways. Smothering the weed by covering it to a depth of at least 6 or 9 inches with manure and straw is the most efficacious method. The manure in fermenting destroys all plant life below it.

Choking the plant out by growing a crop of some vigorous plant such as Lotus or Clover may help to exterminate the weed, and this plan has the advantage of utilising the soil in the process.

It is of the utmost importance to prevent the plants from seeding, since by this method nut grass spreads far more than would be the case if limited to encroachment through the soil. Frequent summer cultivation would encourage the stirred up tubers to grow and this, repeated at intervals, would do much to destroy the plants.

The seeds of nut grass have a hard coat, and except perhaps with sheep, they are not destroyed by ingestion. Manure from horses and cattle that have fed on nut grass is likely to produce new plants.



Nut Grass (*Cyperus rotundus*, Linn.).

Description of the plant.—A perennial grass-like plant with a creeping rhizome swelling at intervals into nut-like tubers. Stems slender, 3-angled, especially towards the top, 8-18in. high. Leaves shorter than the stem, the

sheaths often long and loose. Flowers in little brown spikes called spikelets, usually 6 to 10 together in clusters, in an umbel of a few rays, the outer ones sometimes long and slender, but usually the umbel is rather dense. Spikelets linear, acute, flattened, usually about ½in. long with about 12-20 flowers, the rhachis slightly flexuose and bordered by transparent rather broad wings. Glumes imbricate, more or less distinctly several-nerved, with a usually green prominent keel. Stamens 3, style split into three branches. The nut or seed is obovoid, 3-angled, and less than half as long as the glume.

Cyperus is from the Greek *Kypeiros*, applied probably to the species described above, now used as a name for the genus; *rotundus*, which is Latin for "round" refers to the shape of the tubers of this species.

Nut grass is also known as "Java grass," but the name is not particularly applicable, since the species is indigenous in most temperate and tropical countries.

ROUGH CLOVER.

(*Trifolium scabrum*, Linn.)

C. A. GARDNER,
Government Botanist.

Rough Clover is one of the least known of our clovers, and at the present time is of little importance, because it is only known to occur in small patches in localities near Perth. Like many of our local clovers this plant has now established itself. The plant is one of the late flowering annual clovers, the flowering season synchronising with that of Cluster Clover. So much does it resemble the latter, that it might easily be mistaken for Cluster Clover, and hence its distribution may be more widespread than shown by the records of its occurrence. The plant is more prostrate than Cluster Clover, lying close to the ground with only the ends of the branches assuming an erect position. The stems are coarser, but are fairly succulent, and the whole plant is covered with small rough hairs. The flowering head is stalkless, as in Cluster Clover, but is oblong instead of being spherical. The plant is not very densely foliaged. Rough Clover is a species which appears to be more suited to dry conditions than Cluster Clover. This being so it will be possible to grow it in areas where only the medics have been grown, and although it will not yield any great bulk of seed, it should prove of value in dry pastures. The seeds of this clover are not obtainable locally, and the value of the plant for pasture purposes has yet to be demonstrated.

Description of Plant.—A spreading or procumbent or almost prostrate annual invested with small hairs, the stems somewhat rigid. Leaflets obovate to cuneate-obovate, minutely denticulate, the secondary nerves arching towards the margins. Flower heads ovoid to ovoid-oblong, contracted towards

the base, closely sessile to the axils of the leaves. Flowers white. Calyx leathery, hairy, the throat constricted by a callous ring composed of two lip-like calli; the calyx-lobes lanceolate, becoming rigid, and spreading and recurved after flowering, the lowest longer than the tube. Standard shorter than the calyx. Seeds ovoid, smooth, light yellow, slightly flattened, the radicle not prominent.

Rough Clover (*Trifolium scabrum*, Linn.).

PHOSPHATIC LICKS FOR STOCK.

A COMPARISON OF THE PALATABILITY OF BONE AND MINERAL PHOSPHATES.

GEO. L. SUTTON, Director of Agriculture,

R. P. ROBERTS, B.Sc. (Agric.), Agricultural Adviser.

Very striking evidence of the deficiency of phosphates in their pastures is afforded by the development of a depraved appetite in the stock grazing on them. This abnormal appetite under extreme conditions becomes very strongly marked in cattle, and to a lesser extent in sheep. The depraved appetite or "pica" manifests itself in many ways; the animals may show a desire for excessive amounts of salt or for chewing bones, and in the latter case it is technically known as "osteophagia." In extreme cases it takes the form of a craving for all sorts of rubbish and the animal will then chew leather, rags, etc., and show a desire to lick tins and stones, or as has been found in Western Australia, sheep will develop an appetite for decomposing or dried rabbit carcases. It is then known as "allotriophagia."

Because of the natural craving for bones and even carcase debris which stock develop when their diet is deficient in phosphorus, it is very natural to assume, as did the writers, that stock would take more readily to an organic phosphate like "Bonemeal" than to a "Mineral" Phosphate Lick. To ascertain to what extent this preference existed with regard to sheep, an experiment was carried out at the Chapman and Merredin Experiment Farms during the present autumn. The experiment was elaborated to determine also to what extent the addition of molasses would increase their preference for the mineral lick.

The experimental licks were prepared by the Cuming Smith and Mt. Lyell Farmers Fertilisers Ltd., and had the following composition:—

Lick 1.—Sterilised Bonemeal—4 parts.
Salt—2 parts.

Lick 2.—Finely ground rock phosphate—4 parts.
Salt—2 parts.

Lick 3.—Finely ground rock phosphate—4 parts.
Salt—2 parts.
Molasses—1 part.

A weighed quantity of each lick was placed in suitable containers near water troughs and on camping grounds in the paddocks where the sheep were grazed. At the end of each week the quantity of lick remaining in each container was weighed so as to ascertain the amount taken by the sheep and then the quantity of lick in the container made up to the original weight. The farm's flocks at Chapman, consisting of 297 ewes and 110 lambs, and 456 ewes and 156 lambs at Merredin, were then given access to the licks in the containers.

At both farms the experiment was continued for three weeks and was terminated after the first rains. At Chapman this period was from 26th March to 16th April, and at Merredin from 7th April to 28th April.

The results indicating the relative preference of the sheep for respectively a bone phosphate and mineral phosphate are given hereunder in Table 1, which shows the average weekly consumption per sheep, in ounces, of Licks Nos. 1 and 2.

TABLE 1.—AVERAGE AMOUNT CONSUMED PER SHEEP.

	Chapman.		Merredin.	
	Lick 1. Bonemeal.	Lick 2. Mineral Phosphate.	Lick 1. Bone Phosphate.	Lick 2. Mineral Phosphate.
	ozs.	ozs.	ozs.	ozs.
First week	·11	·09	·05	·11
Second week	...	·02	·05	·17
Third week	·06	·08	·03	·27
Averages	·06	·06	·04	·19

From these results with the mixture of phosphate and salt only it will be seen that only small quantities were consumed, but contrary to expectations, the sheep did not show any preference for the organic phosphate as supplied by the sterilised bonemeal, but accepted the mineral phosphate just as readily at the Chapman farm and much more readily at Merredin.

The effect of adding molasses to the mineral lick is shown hereunder in Table 2.

TABLE 2.

	Chapman.		Merredin.	
	Lick 2. Mineral Phosphate.	Lick 3. Mineral Phosphate and Molasses.	Lick 2. Mineral Phosphate.	Lick 3. Mineral Phosphate and Molasses.
	ozs.	ozs.	ozs.	ozs.
First week	·09	·37	·14	·34
Second week	·02	·41	·17	·29
Third week	·08	·41	·27	·55
Averages	·06	·40	·19	·39

These results show that the sheep have a preference for the mineral lick when molasses is added to it, and this was very much greater at Chapman than at Merredin.

For those who desire to mix their own licks and to add molasses to them, it may be stated that experience has shown that, to ensure ready mixing, it is advisable to mix with the molasses half its weight of water before adding it to the salt and phosphate. The addition of this water also affords those who wish to use an iodised lick a ready means of adding the potassium iodide. This latter, say, at the rate of 1½ozs. per cwt. of phosphate, should be dissolved in hot water, then the molasses added and the liquid evenly distributed through the phosphate and salt previously mixed together.

MURESK EGG-LAYING COMPETITION, 1928-29.

W. T. RICHARDSON,
Poultry Adviser.

The second Egg-laying Competition held at Muresk Agricultural College commenced on the 10th April, 1928, and concluded on the 17th March, or a total of 48 weeks.

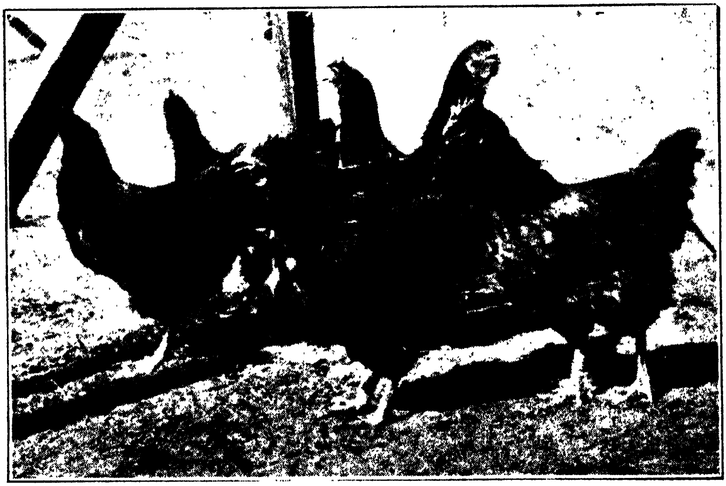
Three sections were provided for, *i.e.*:—

Section "A."—Light breeds, represented by 138 White Leghorns.

Section "B."—Heavy breeds, comprising 132 Black Orpingtons and 6 Rhode Island Reds.

Section "C."—Ducks, consisting of 4 group pens of 6 ducks each.

In Sections "A" and "B" the birds were entered in groups of 6, and every pullet was single-pen tested.



Winners of Competition—Section "B," Black Orpingtons.
(Laid 1,066 1st grade eggs.)
Owner: Mr. J. W. Russell, Osborne Park.

On arrival 15 pullets were rejected on account of crooked breasts and four through being under the weight stipulated. They were all replaced by suitable birds.

One pen of six ducks infested with Stickfast Flea was rejected, and the entry cancelled.

The condition of the birds on arrival was generally good. Some competitors forwarded their pullets in crates unsuitable for birds intended for competition. Small, low crates in which they cannot stand to their full height without striking the top, or squat comfortably, do not tend to give the birds every chance in making a good start.

Mr. J. W. Russell's team of Black Orpingtons put up the highest score in the competition, with a total of 1,066 first-grade eggs, therefore, winning the first prize in that section and the champion certificate for the competition. None of the birds were laying when sent to Muresk, and three out of six did not lay an egg during the month of April. Considering that for the first three weeks of the competition this team showed the lowest scores in its respective section, it put up a most creditable performance by gradually overtaking all other teams and finishing ahead of them. The birds went through the test in fine condition, without showing signs of a moult.

The winner of the second prize in the heavy breeds, Mr. A. F. Lethbridge, led in that section from the commencement of the competition till the fourth week in January, when he was overtaken by the winning term. His scores were 1,012 first-grade eggs.

White Leghorns—Winning team in Section "A."
(Laid 928 1st grade eggs.)
Owner: Mr. R. A. Dusting, Osborne Park.

In the light breeds the team owned by Mr. R. A. Dusting secured first prize with 928 first-grade eggs to its credit. Two birds in this team moulted early, one of which was again in full feather, and commenced laying before the term of the test, a severe handicap on the total scores shown.

Pineapple Poultry Farm secured second place in this section with an aggregate of 830 first-grade eggs.

Hen No. 57, a Black Orpington, owned by Mr. H. Spence, laid 225 first-grade eggs, the highest individual score in Section "B" and for the competition.

The Narrogin School of Agriculture secured first place with hen No. 143, in Section "A," with 220 first-grade eggs to its credit.

In the Duck Section, Mr. F. B. Pepper's team obtained first place with 1,191 2oz. eggs and over.

The winter test (April 10th to July 9th) finished as follows:—

Section "B."—A. F. Lethbridge, 327 first-grade eggs.
Section "A."—R. A. Dusting, 239 first-grade eggs.
Section "C."—F. B. Pepper, 390 2oz. and over eggs.

Fawn and White Indian Runner Ducks—Winners in Section "C."
(Laid 1,412 eggs, 2ozs. and over.)
Owner: Mr. F. B. Pepper, Osborne Park.

Section "B."—Black Orpington Hen, No. 57.
(Highest individual score—laid 225 1st grade eggs.)
Owner: Mr. H. Spence, Rivervale.

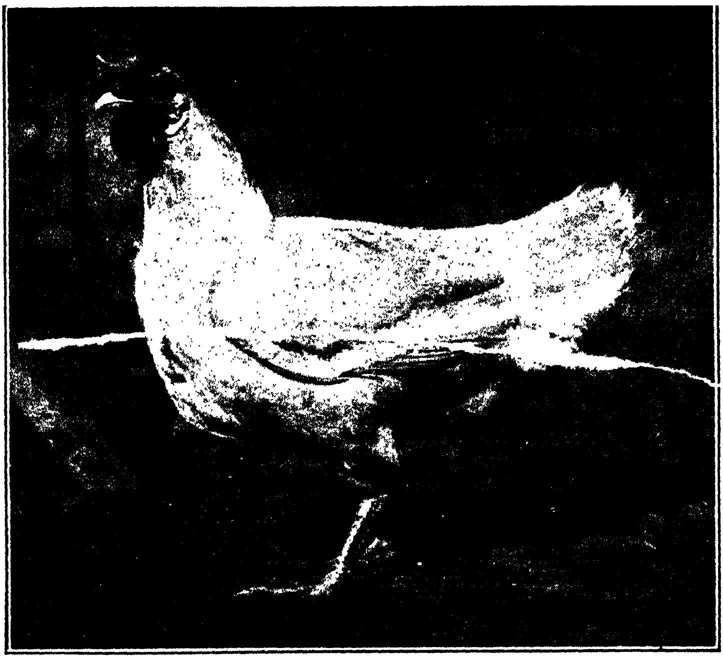
Table No. 1 shows the performance of every team in order of merit.

For the purpose of this competition during the first month a first-grade egg weighed 1¾ozs. and over, and thereafter 2ozs. and over. Only first grade eggs are counted. At any period of the test a second-grade egg had to weigh not more than ¼oz. less than a first-grade egg. Second-grade eggs are recorded, but not counted.

All eggs laid individually weighed at Muresk test.

The cost of feeding averaged 8s. 3d. per bird for the term of the competition.

Table No. 2 gives the monthly production in every section in first-grade, second-grade, and under-weight eggs, followed by the percentage of the various grades to the total output of eggs in each section as well as for the competition.



Section "A."—White Leghorn Hen, No. 143.
Highest individual score—laid 220 1st grade eggs.)
Owner: School of Agriculture, Narrogin.

The table in question indicates that the heavy breed laid:—

(1) More eggs than the light breeds.

(2) A larger percentage of first-grade eggs and a smaller proportion of second-grades than the latter.

(3) A slightly higher percentage of under-weight eggs than Section "A."

The monthly production shows that the number of first-grade eggs increases till the peak production (August) is reached, when their numbers keep decreasing monthly till the end of the competition. On the other hand the second-grade eggs reach their maximum output in November for the light breeds and September for the heavy breeds, while the under-sized eggs are greatest in November and October respectively. As will be noticed, the difference in monthly output of second-grade between October and January is so slight that every or any of those months may be considered the peak period.

TABLE NO. 1.

NO. 2 MURESK EGG LAYING COMPETITION, 1928–1929.

GROUP PENS—FINAL RESULTS.

Section "A."	1st.	2nd.	Section "B."	1st.	2nd.
Dusting, R. A. ...	928	338	Russell, J. W. ...	1,066	99
Pineapple P.F. ...	830	331	Lethbridge, A. F. ...	1,012	110
Brocklehurst, F. ...	802	326	Pelvaurm P.F. ...	847	222
Muja P.F.	697	480	Spence, H.	829	67
Pelvaurm P.F. ...	669	135	Caversham P.F. ...	795	542
Love, M.	666	536	Morningside P.F. ...	756	292
Morningside P.F. ...	657	487	Pelvaurm P.F. (R.I.R.) ...	729	232
Elfdale P.F. ...	601	403	Thompson, G. S. ...	719	253
Paramount P.F. ...	597	598	Neavedale P.F. (2) ...	674	401
Aiken, M.	589	588	Aldervale P.F. (1) ...	666	552
Neavedale P.F. (1) ...	581	112	Mardia P.F. ...	642	535
Neavedale P.F. (2) ...	575	460	Love, M.	617	491
Boulter, T.	570	346	Parkinson, T. ...	616	653
Swanson, H.	556	572	Yaldarra P.F. ...	612	364
Narrogin, S. of Agric.	549	448	Robinson, D. F. ...	593	466
Parkinson, T.	510	358	Windyridge P.F. ...	571	557
Trevor P.F.	500	600	McDonald, N. ...	521	458
Love, A. B.	495	744	Auburn P.F. ...	502	513
Walker, M. (2) ...	470	760	Pineapple P.F. ...	486	677
Priestley, J.	459	607	Elfdale P.F. ...	478	727
Walker, M. (1) ...	447	734	Neavedale P.F. (1) ...	403	316
Russell, J. W. ...	432	608	Aldervale P.F. (3) ...	350	853
Yaldarra P.F. ...	344	877	Aldervale P.F. (2) ...	234	659
	13,524	11,448		14,718	10,039

Section "C."	1st.	2nd.
Pepper, F. B. ...	1,412	45
Martin, E. R. ...	1,191	15
Pepper, M. A. ...	1,183	7
Dusting, R. A. ...	1,157	26
	4,943	93

TABLE NO. 2.

MONTHLY PRODUCTION.

—	Section "A."				Section "B."			
	1st.	2nd.	Under weight.	Total Eggs.	1st	2nd.	Under weight.	Total Eggs.
April	781	432	36	1,249	916	257	32	1,205
May	790	1,044	202	2,036	1,339	929	170	2,438
June	668	948	95	1,711	1,043	1,003	157	2,203
July	1,384	883	18	2,285	1,557	1,014	69	2,640
August	1,791	940	20	2,751	1,719	1,038	94	2,851
September	1,688	995	26	2,710	1,681	1,096	94	2,871
October	1,392	1,288	92	2,772	1,423	1,068	126	2,617
November	1,280	1,329	145	2,754	1,304	972	123	2,399
December	1,200	1,262	138	2,600	1,245	860	124	2,229
January	1,160	1,122	86	2,368	1,111	799	125	2,035
February	854	831	56	1,741	808	662	114	1,584
March	536	374	7	917	572	341	40	953
	13,524	11.448	931	25,903	14,718	10.039	1,268	26 025

—	Sections "A" and "B."				Section "C."		
	1st.	2nd.	Under weight.	Total Eggs.	1st.	2nd.	Total Eggs.
April	1,697	689	68	2,454	209	40	249
May	2,129	1,973	372	4,474	464	3	467
June	1,711	1,951	252	3,914	421	...	421
July	2,941	1,897	87	4,925	394	1	395
August	3,510	1,978	114	5,602	400	1	401
September	3,369	2,091	130	5,590	563	6	569
October	2,815	2,356	218	5,389	516	29	545
November	2,584	2,301	268	5,153	543	3	546
December	2,445	2,122	262	4,829	565	1	566
January	2,271	1,921	211	4,403	497	8	505
February	1,662	1,493	170	4,325	287	1	288
March	1,108	715	47	1,870	84	...	84
	28,242	21,487	2,199	51,928	4,943	93	5.036

PERCENTAGE OF VARIOUS GRADES TO TOTAL OUTPUT OF EGGS.

—	1st.	%	2nd.	%	Under weight.	%	2 ozs. and over.	%	Total, Eggs.
Section "A"	13,524	52·21	11,448	44·19	931	3·59	12,417	47·93	25,903
Section "B"	14,718	56·55	10,039	38·57	1,268	4·87	13,777	52·93	26,025
Sections "A" and "B"	28,242	54·38	21,487	41·38	2,199	4·23	26,194	50·44	51,928
Section "C"	4,943	98·15	93	1·84	...	...	4,943	98·15	5,036

No. 2 MURESK EGG LAYING COMPETITION, 1928–1929.

FROM 10TH APRIL, 1928, TO 17TH MARCH, 1929.

FINAL RESULTS—(INDIVIDUAL AND TEAMS).

SECTION "A" LIGHT BREEDS—(ALL WHITE LEGHORNS).

Competitor.	Individual.					Group.			Remarks.
	Hen No.	1st	2nd	Under weight.	2 ozs. and over.	1st.	2nd.	Under weight.	
Neavedale P.F. (1) ...	1	71	9	...	69	...	...	...	Died, 10-2-28.
	2	139	43	1	139	...	...	...	
	3	141	7	...	137	...	...	...	
	4	186	18	...	176	...	...	...	
	5	...	13	2	...	...	...	...	Died, 27-7-28.
	6	44	22	...	37	581	112	3	Died, 3-11-28.
Brocklehurst, F. ...	7	156	26	2	149	...	...	...	
	8	84	158	...	70	...	...	...	
	9	139	93	2	126	...	...	...	
	10	124	5	...	115	...	...	...	
	11	137	16	...	132	...	...	...	
	12	162	28	1	155	802	326	5	
Paramount P.F. ...	13	2	188	58	1	...	...	...	
	14	124	49	1	118	...	...	...	
	15	207	6	...	201	...	...	...	
	16	63	166	9	48	...	...	...	
	17	52	129	11	36	...	...	...	
	18	149	60	2	149	597	598	81	
Priestley, J. ...	19	73	88	2	65	...	...	...	
	20	72	95	3	67	...	...	...	
	21	167	55	...	152	...	...	...	
	22	41	179	2	41	...	...	...	
	23	89	21	1	77	...	...	...	
	24	17	169	24	10	459	607	32	
Love, A. B. ...	25	29	186	13	21	...	...	...	
	26	146	24	2	136	...	...	...	
	27	85	116	6	74	...	...	...	
	28	125	68	...	114	...	...	...	
	29	48	192	17	28	...	...	...	
	30	62	158	2	48	495	744	40	
Parkinson, T. ...	31	18	133	47	14	...	...	...	
	32	166	45	...	149	...	...	...	
	33	...	60	12	...	...	...	...	
	34	169	15	...	165	...	...	...	
	35	145	2	...	145	...	...	...	Died, 30-12-28.
	36	12	103	19	2	510	358	78	
Morningside P.F. ...	37	51	125	18	51	...	...	...	
	38	122	64	2	110	...	...	...	
	39	3	203	32	3	...	...	...	
	40	113	36	...	113	...	...	...	
	41	180	29	...	172	...	...	...	
	42	188	30	...	170	657	487	52	
Dusting, R. A. ...	43	167	23	2	156	...	...	...	
	44	90	29	...	74	...	...	...	
	45	200	26	1	181	...	...	...	
	46	145	111	...	133	...	...	...	
	47	147	99	1	131	...	...	...	
	48	179	50	...	157	928	338	4	
Pineapple P.F. ...	49	94	85	...	91	...	...	...	
	50	163	18	...	156	...	...	...	
	51	159	26	...	150	...	...	...	
	52	197	2	...	186	...	...	...	
	53	111	94	...	100	...	...	...	
	54	106	106	...	102	830	331	...	
Swanson, H. ...	55	102	96	...	91	...	...	...	
	56	112	58	1	108	...	...	...	
	57	123	13	...	106	...	...	...	
	58	9	216	21	5	...	...	...	
	59	17	185	25	17	...	...	...	
	60	193	4	...	189	556	572	47	
Yaldarra P.F. ...	61	3	181	31	3	...	...	...	
	62	19	193	18	19	...	...	...	
	63	73	98	3	73	...	...	...	
	64	78	157	1	57	...	...	...	
	65	127	105	1	124	...	...	...	
	66	44	143	3	39	344	877	52	

NO. 2 MURESK EGG LAYING COMPETITION, 1928-1929—*continued.*

FINAL RESULTS—INDIVIDUAL AND TEAMS—*continued.*

Competitor.	Individual.					Group.			Remarks.
	Hen No.	1st.	2nd.	Under weight.	2 ozs. and over.	1st.	2nd.	Under weight.	
Trevor P.F. ...	67	117	32	1	110	...	...	...	
	68	140	60	...	130	...	...	...	
	69	50	120	28	34	...	...	...	
	70	27	188	7	21	...	...	...	
	71	55	165	12	43	...	...	...	
	72	111	35	...	99	500	600	48	
Aiken, M.	73	13	187	38	9	...	...	...	
	74	166	41	1	165	...	...	...	
	75	60	124	5	48	...	...	...	Died, 30-12-28.
	76	165	16	1	155	...	...	...	
	77	104	120	2	95	...	...	...	
	78	81	100	5	79	589	588	52	
Walker, M. (1) ...	79	7	195	23	7	...	...	...	
	80	103	55	...	89	...	...	...	
	81	142	70	...	130	...	...	...	
	82	26	130	13	26	...	...	...	
	83	71	146	9	62	...	...	...	
	84	98	138	2	86	447	734	47	
Russell, J. W. ...	85	22	166	34	22	...	...	...	
	86	117	82	6	116	...	...	...	
	87	41	9	...	41	...	...	...	
	88	11	175	42	11	...	...	...	
	89	113	97	3	104	...	...	...	
	90	128	79	...	116	432	608	85	
Muja P.F. ...	133	152	2	1	152	...	...	...	
	134	7	171	44	...	...	...	...	
	135	187	36	...	166	...	...	...	
	136	141	23	...	125	...	...	...	
	137	150	80	1	134	...	...	...	
	138	60	168	3	2	697	480	49	
Narrogin School of Agriculture	139	5	75	64	1	...	...	...	
	140	51	164	11	49	...	...	...	
	141	163	30	...	154	...	...	...	
	142	2	87	27	2	...	...	...	
	143	220	11	...	201	...	...	...	
	144	108	81	2	92	540	448	104	
Walker, M. (2) ...	145	131	74	1	116	...	...	...	
	146	132	92	1	118	...	...	...	
	147	151	90	1	134	...	...	...	
	148	2	156	14	2	...	...	...	
	149	8	200	33	8	...	...	...	
	150	46	148	11	42	470	760	61	
Pelvaurm P.F. ...	151	82	3	...	82	...	...	...	
	152	180	15	...	170	...	...	...	
	153	147	3	...	131	...	...	...	
	154	95	78	1	80	...	...	...	
	155	101	36	...	101	...	...	...	
	156	64	...	...	64	669	135	1	
Neavedale P.F. (2) ...	157	171	5	...	152	...	...	...	
	158	95	101	1	88	...	...	...	
	159	62	26	1	62	...	...	...	
	160	171	30	...	155	...	...	...	
	161	55	146	6	50	...	...	...	
	162	21	152	4	15	575	460	12	
Elfdale P.F. ...	163	146	17	1	146	...	...	...	
	164	175	27	...	173	...	...	...	
	165	79	33	...	79	...	...	...	
	166	24	174	9	17	...	...	...	
	167	160	3	...	160	...	...	...	
	168	17	149	35	3	601	403	45	
Boulter, T.	169	149	57	...	131	...	...	...	
	170	111	56	1	99	...	...	...	
	171	127	34	...	123	...	...	...	
	172	27	21	2	20	...	...	...	
	173	44	90	1	44	...	...	...	Died, 19-11-28.
	174	112	88	1	94	570	346	5	
Love, M.	175	40	170	8	31	...	...	...	
	176	94	97	...	86	...	...	...	
	177	89	125	1	72	...	...	...	
	178	152	14	...	146	...	...	...	
	179	139	88	...	119	...	...	...	
	180	152	42	2	145	666	536	11	

SECTION "B."—HEAVY BREEDS.

Competitor.	Hen No.	1st.	2nd.	Under weight.	2 ozs. and over.	1st.	2nd.	Under weight.	Remarks.
Aldervale P.F. (1)	1	182	50	1	175	...	...	...	
	2	129	76	...	126	...	...	...	
	3	139	45	1	127	...	...	...	
	4	3	203	39	...	...	...	...	
	5	169	55	...	149	...	...	...	Died, 13-2-29.
	6	44	123	...	43	666	552	41	
Elfdale P.F. ...	7	38	202	3	38	...	...	...	
	8	175	47	1	174	...	...	...	
	9	170	26	2	170	...	...	...	
	10	12	235	5	12	...	...	...	
	11	32	58	19	13	...	...	...	
	12	51	159	31	48	478	727	61	
Mardia P.F. ...	13	108	35	3	95	...	...	...	
	14	11	170	43	1	...	...	...	
	15	154	30	1	134	...	...	...	
	16	158	100	2	133	...	...	...	
	17	25	177	13	9	...	...	...	
	18	186	23	3	176	642	535	65	
Neavedale P.F. (1)	19	20	123	7	1	...	...	...	
	20	17	158	44	4	...	...	...	Died 19-10-28.
	21	140	19	1	133	...	...	...	
	22	67	...	...	65	...	...	...	
	23	39	14	1	27	...	...	...	
	24	120	2	1	120	403	316	54	
Pineapple P. F. ...	25	158	46	1	141	...	...	...	
	26	39	166	21	30	...	...	...	
	27	34	157	8	23	...	...	...	
	28	22	173	5	17	...	...	...	
	29	126	58	...	120	...	...	...	
	30	107	77	...	105	486	677	35	
Auburn P.F. ...	31	15	170	37	5	...	...	...	
	32	142	124	1	119	...	...	...	
	33	5	115	112	2	...	...	...	
	34	151	...	...	149	...	...	...	
	35	89	103	2	86	...	...	...	
	36	100	1	...	100	502	513	152	Died, 30-12-28.
Caversham P.F. ...	37	169	67	2	161	...	...	...	
	38	105	110	10	185	...	...	...	
	39	82	94	2	81	...	...	...	
	40	109	129	...	93	...	...	...	
	41	150	109	2	127	...	...	...	
	42	180	33	...	174	795	542	16	
Aldervale P.F. ...	43	3	119	172	1	...	...	...	
	44	79	120	1	64	...	...	...	
	45	22	132	40	13	...	...	...	
	46	1	36	141	1		...	...	Died, 30-1-29.
	47	1	148	82	1	...	...	437	
Love M.	48	128	95	1	128	234	659	...	
	49	164	8	...	155	...	...	...	
	50	46	121	...	31	...	...	...	
	51	134	27	1	131	...	...	...	
	52	35	211	6	13	...	...	...	
	53	75	105	7	60	...	...	14	
Spence H.	54	163	19	...	163	617	491	...	
	55	6	1	..	6	...	...	...	
	56	193	1	...	193	...	...	...	
	57	225	4	...	221	...	...	...	
	58	144	9	2	141	...	...	...	
	59	130	10	2	127	...	...	5	
Parkinson T. ...	60	131	33	1	130	829	67	...	
	61	17	208	8	2	...	...	...	
	62	45	128	18	27	...	...	...	
	63	148	97	...	130	...	...	...	
	64	102	77	3	95	...	...	...	
	65	86	139	4	70	...	...	33	
Windyridge P.F. ...	66	218	4	...	216	616	653	...	
	73	108	118	...	90	...	...	...	
	74	1	124	68	1	...	...	...	
	75	152	35	...	147	...	...	...	
	76	110	134	...	97	...	...	...	
	77	163	17	...	159	...	...	72	

SECTION "B"—HEAVY BREEDS—*continued.*

Competitor.	Hen No.	1st.	2nd.	Under weight.	2 ozs. and over.	1st.	2nd.	Under weight.	Remarks.
Morningside P.F. ...	78	37	129	4	17	571	557	...	
	79	146	72	1	142	...	...	...	
	80	156	37	...	142	...	...	...	
	81	76	69	3	69	...	...	...	
	82	46	66	12	30	...	...	...	
	83	166	29	...	160	...	...	17	
Aldervale P.F. ...	84	166	19	1	165	756	292	...	
	85	6	191	35	5	...	...	...	
	86	63	135	2	63	...	...	...	
	87	16	161	50	7	...	...	...	
	88	45	152	3	44	...	...	...	
	89	197	60	2	187	...	...	...	
	90	23	154	32	19	350	853	124	
Russell, J. W. ...	91	209	1	...	208	...	...	...	
	92	171	5	...	168	...	...	...	
	93	210	...	...	207	...	...	...	
	94	85	87	7	78	...	...	...	
	95	190	6	...	189	...	...	...	
	96	201	...	...	199	1,066	99	7	
Lethbridge, A. F. ...	97	204	...	...	203	...	...	...	
	98	152	4	...	152	...	...	...	
	99	143	9	...	141	...	...	...	
	100	216	13	...	214	...	...	...	
	101	129	41	...	114	...	...	...	
	102	168	43	...	159	1,012	110	...	
Neavedale P.F. (2)	103	126	106	1	106	...	...	...	
	104	159	...	...	159	...	...	...	
	105	10	6	...	5	...	...	...	
	106	201	...	...	201	...	...	...	Died, 20-9-28.
	107	156	76	...	154	...	...	...	
	108	22	213	34	4	674	401	35	
Yaldarra P.F. ...	109	64	118	4	53	...	..	...	
	110	89	28	1	75	...	...	...	
	111	164	21	...	160	...	...	...	
	112	21	161	31	12	...	...	...	
	113	156	6	1	152	...	...	...	
	114	118	30	...	115	612	364	37	
Thompson, G. S. ...	115	132	...	...	131	...	...	...	
	116	125	24	...	119	...	...	...	
	117	183	14	...	180	...	...	...	
	118	116	64	5	111	...	...	...	
	119	32	150	12	12	...	...	...	
	120	131	1	...	128	719	253	17	
Pelvaurm P.F. ...	121	118	67	1	108	...	...	...	
	122	60	113	...	49	...	...	...	
	123	161	21	...	154	...	...	...	
	124	181	3	1	179	...	...	...	
	125	161	17	...	158	...	...	...	
	126	166	1	...	164	847	222	2	
Robinson, D. F. ...	127	153	35	1	143	...	...	...	
	128	140	80	...	124	...	...	...	
	129	128	58	1	124	...	...	...	
	130	99	30	2	90	...	...	...	
	131	43	155	25	25	...	...	...	
	132	30	108	6	21	593	466	35	
Pelvaurm P.F. (R.I.R.)	133	170	8	...	169	...	...	...	
	134	152	13	...	152	...	...	...	
	135	138	37	1	129	...	...	...	
	136	82	42	1	82	...	...	...	
	137	52	55	1	39	...	...	...	
	138	135	77	...	119	729	232	3	
McDonald, N. ...	139	33	140	3	31	...	...	...	
	140	42	39	...	42	...	...	...	
	141	128	62	1	105	...	...	...	
	142	136	76	2	132	...	...	...	
	143	117	34	...	110	...	...	...	
	144	65	107	...	65	521	158	6	
SECTION "C."—DUCKS—(6 Birds, Group tested.)									
Martin, E. R. ...	1	1,191	15	..	1191	...	...	...	
Pepper, F. B. ...	2	1,412	45	...	1,412	...	...	...	
Pepper, M. A. ...	3	1,183	7	...	1,183	...	...	...	
Dusting, R. A. ...	4	1,157	26	...	1,157	...	...	...	

CULTIVATION OF ONIONS.

(Continued from March issue.)

E. T. MORGAN,
Vegetable Inspector.

PREPARATION OF LAND.

The preparation of the land for the reception of onion plants is of primary importance, as a good stand, and consequently a good crop will not be obtained from a cloddy paddock. The adage "as fine as an onion bed" is a true one, and in order to obtain a tilth corresponding to this description, such operations as ploughing, harrowing and levelling must be properly carried out. The exact number of times each operation should be performed is not important. One operation is a good as several if a satisfactory tilth is obtained. On the other hand, an indefinite number is not sufficient if the land is still loose, cloddy or uneven.

A sandy loam is usually brought into condition quite easily, but with a clay soil a much more difficult matter has to be faced, and such a soil should be worked as early in the season as possible, before heavy rains set in. It is a good plan to plough the land in the spring and allow it to lie fallow through the summer. At the period of the first rains, say in March, it will be found possible to cultivate the land and bring into good condition sooner than would be possible if left uncultivated until the early part of the growing season.

MANURING.

Onions, like most vegetable crops, need a complete fertiliser and adequate amounts of nitrogen, phosphoric acid and potash are especially important. Properly kept farmyard manures contain these elements, and if the onion-grower has command of a good supply of well-rotted manure, he is in a happy position. If the amount of stable manure is limited, a moderate dressing supplemented by a mixture of artificial fertiliser makes a very good combination. Most of our South-West growers, however, are unable to accumulate stocks of manure—owing to the animals not being stabled—and, therefore, have to rely solely on artificial fertilisers. Many growers follow the system of green manuring, although this is not carried out to the extent is should be. Ploughing in greenstuff is an effective method of improving the humus content of the soil, and as motor transport is rapidly doing away with the horse, this method of supplying humus must be much more resorted to among vegetable growers than is at present. Soil bacteria is much more active in a soil containing a large amount of decomposed vegetable matter, and hence the farmer who wishes to get the best return for his labour will endeavour to supply this very necessary agent.

As the onion is a long-growing plant, the application of a fertiliser containing bone dust, which is fairly slow acting, is good, and a mixture of 4 parts blood and bone, 2 parts of superphosphate, and 1 part of potash, and applied at the rate of 10 cwt. per acre has given satisfactory results. No. 3 or No. 4 Mt. Lyell and Brand "B" or "E" Cuming Smith's Potato Manures are much used, and are suitable fertilisers. This can be sown broadcast and well worked into the land prior to planting, or sown along

the furrow in the same manner as is usually done when planting potatoes. This method is described later, under the heading of transplanting. It is advisable to topdress the plot when the onion bulbs are about one inch in diameter with one of the above mixtures, or a combination of 3 parts superphosphate and 1 part of sulphate of ammonia, applied at the rate of 1-1½ cwts. per acre.

It is not recommended that highly nitrogenous fertilisers be used in the early stages of growth, as these mixtures stimulate top growth and often cause thick stemmed or "bottle-necked" plants, which are not desirable and seldom produce good bulbs.

TRANSPLANTING.

When the plants are from 4-6 inches high, and are nice and sturdy, they are fit for transplanting. They should be dug from the bed, so as to injure the roots as little as possible. As the roots are fairly long, and it is not practicable to make a hole large enough to spread out these roots evenly, it is customary to trim them with a sharp knife to the length of approximately ¾ inch. As there is a balance between root and top to be maintained, it is reasonable to suggest that, as a compensation for this loss, a portion of the top should be cut off, and if an inch or so is removed this will conform to common practice. It is, of course, not suggested that each plant be treated separately, but if a handful of plants are placed on a board the operation can be quickly performed.

The rows should be marked out with the aid of a marker as previously described, but with the "tynes" 1 foot apart. If a line is laid out at one side of the area to be planted, and the outside tyne kept close to it—allowing 4 tynes to the structure—we have 4 rows one foot apart. Again, keeping the outside tyne in the last row marked, we have 3 more rows, and so on. Do not mark too deeply, as onion plants should be planted very shallow. A method often adopted in the South-Western portion of the State is to use the plough. A furrow is struck out, a dressing of fertiliser run along it fairly close to the surface, and another furrow turned over against it. The onion plants are then placed along the intersection of the two furrows, and if the ploughman is expert a straight row is the result. If the plough will turn a furrow of 11 or 12 inches, they may be planted one furrow apart, but if the plough will cut only a narrow width, it is advisable to allow two furrows between the rows. This method allows the planter to walk along the furrow, and so obviates the necessity for trampling the surface of the land during the planting operation; a great advantage if the land is inclined to be wet. If the paddock has been well prepared previous to the transplanting operation, it should plough back very level, and a drag or wheel hoe run along between the rows will leave the plot in good order.

VARIETIES.

The following varieties are recommended:—

Brown Spanish.—The best known variety in cultivation; it is most popular for general use. A good grower and keeper.

Brown Globe.—An onion similar to Brown Spanish, but more globular. It shares the latter's popularity for weight-producing.

White Globe.—This is perhaps the finest white onion at present in existence. Bulbs of medium size, mild flavour and juicy.

New Queen.—A silver-skinned onion of quick growth and mild flavour. It is often grown for producing an early crop.

Early Barletta.—The earliest white onion grown. It is not a good keeper, but sown early is very profitable.

CULTIVATION.

Much of the success of the onion crop depends on the amount and efficiency of the cultivation. Cultivation has a twofold purpose; it breaks the crust that has formed because of heavy rains, and also keeps down weeds. Onions cannot compete against weeds, which rob them of nourishment, water and sunlight; hence, the crop must be kept absolutely clean. Wheel hoes are most extensively used for cultivation between the rows, but they cannot remove weeds from between the plants in the rows. This must be done by hand, a tedious process, but an essential one. Small hoes are obtainable 2½-3 inches wide. If the plants are placed about 4 inches apart, this width will allow the effective use of one of these hoes between them. Some growers prefer to allow sufficient width between the rows to allow of horse cultivation. This will tend to decrease the cost of cultivation, but care should be taken not to throw the soil too far and cover the developing bulbs. Onion bulbs develop best when near the surface of the ground, and will not grow as large nor be as good keepers if buried deeply in the soil.

HARVESTING.

Onions take from six to seven months to reach complete development. Bending the stems over is a great aid to ripening; a light roller drawn over them is sometimes used, and it is quite effective. It is not wise to allow the onions to remain in the ground long after the tops have died down as there is always danger of sunburn, and harvesting takes place during the hot weather. When the tops have yellowed and turned down the bulbs should be lifted and carted to a shady place, preferably an open shed, and spread out thinly, taking care not to bruise the bulbs, or decay will soon set in. An ideal way of harvesting is to place the onions in crates; they can then be stacked one on top of the other, and the air circulating through the slatted sides cures them slowly and effectively. When the tops are dry and shrivelled the onions are fit for market, and no fear need be felt as to their carrying qualities. Growers of very early crops often pull the onions when they have reached a marketable size, and cut off the tops about an inch above the bulb. The onions are quite green, but are fit for immediate use, and when prices are high and where the grower is near the market—as they do not carry well—it no doubt pays him, but for the average onion grower it pays to properly harvest the onion before marketing.

SUMMARY.

1. It is desirable for the grower to have seed grown under his own supervision.
2. Great importance is attached to the selection of mother bulbs.
3. Correct fertilising is necessary.
4. The land should be kept free from weeds during the growing period.
5. Harvesting practices should be planned so as to avoid sun-burned and immature bulbs.

FIELD EXPERIMENTS WITH WHEAT.

AVONDALE STATE FARM.

A. S. WILD, Agricultural Adviser.
H. J. BAILEY, Farm Manager.

During 1928 five experiments with wheat were conducted at this farm. They were:—

1. Rate of Seeding Experiment.
2. Basic Slag and Superphosphate Experiment.
3. Rate of Superphosphate Experiment.
4. Time of Application of Superphosphate Experiment.
5. Liming Experiment.

The land on which the experiments were conducted was typical York Gum and Jam country which had been cleared a number of years. It had been ploughed during the previous July to a depth of four to five inches with a mouldboard plough, spring-tyne cultivated in February and again immediately prior to drilling.

Each plot was one-eighth of an acre in area and repeated to form five sections for each experiment, except the Liming Experiment, which was in triplicate.

The monthly rainfalls as recorded at Beverley, four miles distant, are set out hereunder:—

—	Jan.	Feb.	Mch.	Apl.	Useful Rains.							Nov.	Dec.	Total for Year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1928 ...	56	..	18	44	146	145	564	331	141	41	1,368	3	31	1,520
Average 43 years	31	42	64	87	218	317	329	248	170	99	1,381	45	40	1,690

The rainfall recorded during the growing period (May to October) was about equal to the average. However both May and June were unusually dry, these months being followed by a period of heavy soaking rains. These terminated abruptly in September and a dry period was experienced at the end of September and during the month of October.

The dry spell in May did not allow for an efficient cultivation of the fallowed land to control weeds, the growth of which was assisted by the heavy rains in July.

Under these conditions, crops grown with seed applied in quantities larger than usual gave better returns. Weeds were placed at a disadvantage in liberally seeded crops and the losses through malting and other causes were not felt so appreciably.

RATE OF SEEDING EXPERIMENT.

In this experiment the midseason variety, "Nabawa" was planted at three different rates, viz., 90 lbs., 45 lbs., and 60 lbs. per acre. The results obtained together with the average percentage results for the past three years are set out hereunder:—

AVONDALE STATE FARM.

RATE OF SEEDING EXPERIMENT.

GRAIN YIELDS.

Variety—Nabawa. Rate of Superphosphate 100lbs. per acre. Planted 10th May, 1928.

Rate of Seed per Acre.	Computed Yield per Acre.					Average Yield, per Acre.	Per-centage, 1928.	Per-centage, 1926-28.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
90lbs.	20 55	21 55	21 40	20 3	20 3	20 55	127	114
45lbs. (Control) ...	16 44	17 36	16 44	15 8	15 59	16 26	100	100
60lbs.	19 56	19 26	18 6	18 6	15 38	18 14	111	107

The above results conclusively indicate that, under the conditions of growth at the Avondale State Farm, applications of seed heavier than 45 lbs. per acre are profitable. The results at the experimental farms situated in portions of the Wheat Belt, other than the Great Southern, are equally conclusive in establishing that 45 lbs. per acre of seed of the variety Nabawa is sufficient.

BASIC SLAG AND SUPERPHOSPHATE EXPERIMENT.

As in previous years this experiment was carried out with 22 per cent. superphosphate and 17 per cent. basic slag (Thomas Phosphate.)

It was designed to ascertain the advantage, if any, obtained when phosphoric acid was applied to the soil in basic slag, as compared with phosphoric acid when applied in superphosphate.

The plots were arranged so that both the amount (by weight) and the quality (percentage of phosphoric acid) of the fertiliser applied per acre were compared with 22 per cent. superphosphate, the principal fertiliser used by wheat farmers.

To meet these requirements three plots were planted, viz.:—

1. 75 lbs. per acre of 17 per cent. basic slag (equal by weight to control.)
2. 75 lbs. per acre of 22 per cent. superphosphate (control).
3. 97 lbs. per acre of 17 per cent. basic slag (supplying the same amount of phosphoric acid as 75 lbs. of superphosphate.)

The area of each lot was one-eighth of an acre, and each section was repeated five times.

There was a marked difference between the plots throughout the growing period, these differences being indicated in the subsequent grain yields

which together with the averaged results for the past three years, are set out in the table hereunder:—

AVONDALE STATE FARM.

BASIC SLAG AND SUPERPHOSPHATE EXPERIMENT.

GRAIN YIELDS.

Variety—Nabawa. Rate of Seed 45lbs. per acre. Planted 12th May, 1928

Rate of Fertiliser per Acre.	Relative quantities Phosphoric Acid per acre.	Computed Yields per Acre.					Average Yield per Acre.	Per-centage Yield, 1928.	Per-centage Yield, 1926–28.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
	%	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
97lbs., 17 % Basic Slag	100	12 55	12 55	12 26	12 19	9 21	11 59	83	83
75lbs., 22 % Superphosphate	100	14 39	14 16	15 8	14 46	13 47	14 31	100	100
75lbs., 17 % Basic Slag	77	12 55	12 26	13 32	11 49	10 50	12 18	85	81

Although there is not a great difference in the results obtained from the plots receiving the two different rates of basic slag, there is, however, a considerable difference between these and the control plot of 75 lbs. of superphosphate, and it can be concluded from these results that the wheat plants' requirement of phosphoric acid is best supplied by superphosphate.

RATES OF SUPERPHOSPHATE EXPERIMENT.

The midseason variety Nabawa was also planted in this experiment and was sown at the rate of 45 lbs. per acre.

The results obtained this year, together with the average percentage results for the past three years are as hereunder:—

AVONDALE STATE FARM.

RATE OF SUPERPHOSPHATE EXPERIMENT.

GRAIN YIELDS.

Variety—Nabawa. Rate of Seed 45lbs. per acre. Planted 11th May, 1928.

Rate of Superphosphate per acre.	Computed Yield per Acre.			Average Yield per acre.	Percentage Yield, 1928.	Percentage Yield, 1926–28.
	Section 2.	Section 3.	Section 4.			
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
225 lbs.	14 13	13 58	13 3	13 45	102	106
75 lbs. (Control)	13 35	13 20	13 28	13 28	100	100
150 lbs.	14 58	13 28	13 43	14 3	104	107

It was obvious that the yields obtained from some of the plots in Sections 1 and 5 had been affected by some unaccountable factor, and consequently they are not used for comparison.

These results show that better yields are obtained when the rate of superphosphate is increased above 75 lbs. per acre.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

The object of this experiment which was commenced in 1928 is to determine whether, when applying heavy dressings of superphosphate it would be economical to apply part or all of the fertiliser when cultivating during the late summer or early autumn months.

The times of applying the superphosphate and the results for the season are as hereunder:—

AVONDALE STATE FARM.

TIME OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

GRAIN YIELDS.

Variety—Nabawa. Seed—45lbs. per acre. Planted 10th May, 1928.

Time of Application of Superphosphate.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yield per Acre.	Percentage Yield, 1928.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	
75 lbs. in March ... 150 lbs. at planting ...	10 50	10 58	12 28	11 43	9 51	11 10	111
225 lbs. in March	9 26	10 21	11 58	9 58	8 44	10 5	100
150 lbs. in March ... 75 lbs. at planting ...	10 58	10 21	11 28	10 58	10 58	10 57	109

These results are undoubtedly in favour of those plots which received dressings of superphosphate at seeding time. They indicate, as do the results of similar experiments conducted at the other experiment farms, that the wheat yields are decreased when portion of the fertiliser is not applied at seeding time.

LIMING EXPERIMENT.

The object of this experiment is to ascertain whether an application of agricultural lime at the rate of 10 cwts. per acre is advantageous for the wheat crop.

This lime was applied a month prior to seeding, viz., on the 15th April, 1928. This procedure enabled the lime to commence its actions on the soil and also safeguarded the superphosphate (applied at seeding) from undue interference, and consequent "reversion." All plots were planted with the variety "Nabawa" and superphosphate was applied at the rate of 100 lbs. per acre.

The results obtained for this year together with the average results for 1927-28 are as hereunder:—

AVONDALE STATE FARM.

LIMING EXPERIMENT.

GRAIN YIELDS.

Variety—Nabawa. Rate of Seed—45lbs. per acre. Rate of Superphosphate—100lbs. per acre. Planted 10th May, 1928.

Lime applied.	Computed Yield per Acre. Section 1.	Section 2.	Section 3.	Average Yield per acre.	Percentage Yield, 1928.	Average Percentage Yield, 1927–28.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
10cwt. per acre	11 21	12 13	13 28	12 21	99	95
No lime	11 36	12 58	12 58	12 31	100	100

These results, which are for two years only do not, so far, indicate that lime, when applied in the autumn prior to seeding to this class of soil, has a beneficial effect on the wheat crop.

FIELD EXPERIMENTS WITH WHEAT AT THE SALMON GUMS EXPERIMENT FARM.

I. Thomas, Superintendent of Wheat Farms.

L. Senior, Farm Manager.

In addition to the results already published in the March issue of the *Journal of Agriculture* the following field experiments were conducted at the Salmon Gums Experiment Farm during 1928:—

FALLOW AND NON-FALLOW EXPERIMENT.

EARLY OR LATE FALLOWING EXPERIMENT.

The following table shows the monthly rainfall for 1928, together with the average as officially recorded at Salmon Gums, one mile distant from the farm:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period.							Nov.	Dec.	Total for Year.
					May	June	July	Aug.	Sep.	Oct.	Total.			
1928 ...	60	6	65	72	60	50	145	140	91	93	579	...	10	792
Average 10 years	22	48	118	117	157	144	137	136	126	136	836	70	82	1,293

The rainfalls during the growing periods May-October for each of the past ten years, 1919-1928, are set out hereunder, together with corresponding annual rainfalls:—

—	1919.	1920.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.
May-October ...	726	955	1,203	1,030	845	832	750	725	744	579
Jan.-December ...	1,584	1,298	1,546	1,427	1,413	1,181	1,433	1,263	1,165	792

FALLOW AND NON-FALLOW EXPERIMENT.

This experiment was carried out in order to obtain a comparison of the yields from new land cropped after being prepared for seeding by ploughing during the previous winter months, with land cropped after a cultivation prior to seeding only.

The land in which the experiment was conducted was Gimlet, Black Mallee and Silver-bark country, cleared in 1926/27 by rolling and burning.

The fallowed plots were ploughed with a disc implement during July 1927. They received no further attention until prior to seeding, when along with the unfallowed plots, they were cultivated with a springtyne implement.

The results obtained were as follow:—

TABLE 10.

FALLOW AND NON-FALLOW EXPERIMENT.

PLANTED 28TH MAY, 1928.

Variety—Gluyas Early. Seed—45lbs. per acre. Superphosphate (22%) 90lbs. per acre

FALLOW.	NON-FALLOW.
Average of Plots 1 and 3.	Plot 2.
bus. lbs. 13 11	bus. lbs. 6 27
100 %	49 %

The difference in yields of the plots is considerable and although the results are for one year only they confirm in no uncertain manner the information obtained elsewhere, viz., that the yields are considerably increased by fallowing the land for the wheat crop.

EARLY OR LATE FALLOWING EXPERIMENT.

The object of this experiment is to ascertain whether the time of carrying out the initial operation of fallowing, *i.e.*, ploughing, has any effect upon the yields of the resultant wheat crop.

For the purpose of the experiment, three plots, repeated so as to give five sections, were required. It was intended that the respective plots should be ploughed during March, June and September, but the ploughing of the March plot was unavoidably delayed until May.

The ploughing was carried out with a disc implement to a depth of 4 inches. Apart from the ploughing, all plots received similar treatment.

In September they were cultivated with a disc implement and during the last week in October they were harrowed. During January they were springtyne cultivated and this cultivation was repeated immediately prior to seeding.

TABLE G.

SALMON GUMS EXPERIMENT FARM.

EARLY OR LATE FALLOWING EXPERIMENT.

Planted 14th May, 1928.

Variety—Nabawa. Seed—45lbs. per acre. Superphosphate (22%) 90lbs. per acre.

Time of Ploughing.	Computed Yields per acre.					Average Yield, 1928.	Percentage Yield, 1928.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.		
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	
May	19 36	17 4	13 4	15 36	13 44	15 52	100
June	20 0	16 16	15 4	14 32	13 36	15 52	100
September ...	17 12	15 4	15 20	12 32	14 8	14 48	93

From these results which are for one year only, it would appear that the yields are increased when the land is ploughed during the early winter months. These results also confirm the results obtained from a somewhat similar experiment conducted at the Merredin Experiment Farm.

FIELD EXPERIMENTS WITH WHEAT AT THE YILGARN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
G. K. STEVENS, Farm Manager.

In addition to the results already published in the March issue of the Journal of Agriculture, the following field experiments were conducted at the Yilgarn Experiment Farm, during 1928:—

MULCHING EXPERIMENT.

Below are tabulated the monthly rainfalls recorded at the farm for 1928, together with the monthly averages for the past 35 years as recorded at Southern Cross, a distance of eight miles west of the farm:—

	Jan	Feb.	Mch.	Apl.	Growing Period.							Nov.	Dec.	Total for Year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1928 ...	92	...	62	50	170	76	165	89	48	8	556	...	57	817
Average 35 years	47	57	86	73	143	143	146	115	76	62	685	45	48	1,041

MULCHING EXPERIMENT.

The object of this experiment is to determine how far and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer months.

It was conducted at this farm for the first time last season, the land which had originally carried heavy Gimlet and Salmon Gum timber, being prepared as follows: —

All the plots were ploughed with a disc cultivating plough during the July of the previous year. Plots 1 and 2 received a cultivation with a spring-tyne implement in the middle of September. The plots which were to be cultivated after rain during summer were so treated on five occasions, towards the end of September, the second week in October, and during the last weeks of December, January and March.

Owing to the formation of a hard crust on the plots which were not cultivated during the summer, the whole series was cultivated during May and again immediately before drilling.

The results obtained are set out below.

YILGARN EXPERIMENT FARM.—MULCHING EXPERIMENT.

Variety—Gluyas Early. Seed—43lbs. per acre. Planted 10th May, 1928. Superphosphate—75lbs. per acre.

Treatment.	Computed Yield per Acre.										Average Yields, 1928.		Percentage Yields, 1928.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.				
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	
Cultivated in Spring, after summer rains and before planting	21	52	20	48	21	52	22	13	24	0	22	9	108
Cultivated in spring and before planting only	17	57	20	59	21	9	20	26	21	41	20	26	100
Cultivated before planting only	18	29	21	20	21	52	22	12	21	41	21	7	103

The results from those plots receiving cultivations after summer rains show an increase over those from plots not so treated. However, as the returns are for one year only, definite conclusions cannot as yet be drawn.

FIELD EXPERIMENTS WITH WHEAT AT THE CHAPMAN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
P. JEFFREY, Farm Manager.

In addition to the results already published in the March issue of the "Journal of Agriculture," the following field experiments were conducted at the Chapman Experiment Farm last year:—

Depth of Ploughing Experiment.
Mulching Experiment.

The following table shows the monthly rainfall recorded at the farm during the year, together with the averages for the past 23 years:—

—	Jan.	Feb.	Mch.	Apl.	Growing Period.							Nov.	Dec.	Total for Year.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
1928 ...	56	...	40	35	315	262	603	243	139	85	1,647	4	7	1,789
Average 23 years	27	50	69	43	227	432	394	264	172	97	1,586	26	29	1,830

DEPTH OF PLOUGHING EXPERIMENT.

This experiment was conducted on land which was ploughed to the respective depths during September, 1927, with a mouldboard plough. The plots were cultivated with a springtyne implement during October, 1927, again in March, 1928, and also immediately prior to seeding. Owing to the cloddy nature of the land disc harrows preceded the drill.

This experiment is designed to determine the comparative effects upon the resulting crop of ploughing at different depths. For the purpose of the experiment three plots were required, which were ploughed as follows:—

Plot 1.—4 inches, representing shallow ploughing.
Plot 2.—6 inches, representing medium ploughing.
Plot 3.—8 inches, representing deep ploughing.

The plots were each one-eighth of an acre in area, and were repeated five times.

The seed was planted in a dry seed bed. Germination was good, and the plots throughout their growth presented an even appearance.

The results obtained this year, together with the average results for the past 12 years, are as follow:—

DEPTH OF PLOUGHING EXPERIMENT.

Variety—Nabawa. Planted 18th May, 1929. 45lbs. Seed per acre.
112lbs. Superphosphate (22%) per acre.

Plot No.	Depth of Ploughing.	Computed Yields per Acre.					Average Yield per Acre, 1928.	Percentage Yield, 1928.	Average Percentage Yield, 1915–28.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
1	4 inches	18 32	23 4	20 40	19 44	18 56	20 8	97	101
2	6 „	19 4	21 44	23 20	19 28	19 28	20 40	100	100
3	8 „	21 4	21 20	20 56	16 24	18 40	19 36	95	103

The results for this year are slightly in favour of the six-inch ploughing. The average results for the past ten years demonstrate, however, that no economic advantage is to be gained by ploughing to a depth greater than four inches.

MULCHING EXPERIMENT.

The object of this experiment is to determine how far and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer months.

The experiment has been conducted since 1914, and as in previous years the following system of cultivation was adopted:—

Plot 1.—Cultivated during spring, again when required during summer after 25 points of rain or over, and again prior to seeding, the object being to maintain a mulch throughout the fallowed period and to destroy weed growth.

Plot 2.—Cultivated during spring and prior to seeding only (ordinary fallow).

Plot 3.—Cultivated prior to seeding only (neglected fallow).

The land upon which the experiment was conducted was originally lightly timbered with Jam (*Acacia acuminata*), and at the time of planting was rather loose owing to the absence of summer and early autumn rains.

The land was ploughed during August, 1927, with a mouldboard plough to a depth of four inches. The plots received the necessary cultivations mentioned above, the plots in the first section being cultivated seven times during the summer. The seed was sown on a dry seed bed, no weed growth being in evidence at that time. However, the plots which had been cultivated prior to planting only were rather cloddy.

The results obtained are as given below:—

CHAPMAN EXPERIMENTAL FARM.

MULCHING EXPERIMENT.

Variety—Nabawa. Seed—45lbs. per acre. Superphosphate (22 %) 112lbs. per acre. Planted 18th May, 1928.

Plot No.	Treatment.	Computed Yields per Acre.					Average Yield, 1928.	Average Percentage Yield, 1928.	Average Percentage Yield, 1914-28.
		Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
		bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.		
1	Cultivated in spring, after summer rains and before planting	15 52	16 8	16 8	16 0	15 44	16 0	111	108
2	Cultivated in spring and before seeding	15 12	15 28	13 20	14 32	13 36	14 24	100	100
3	Cultivated before seeding only	14 48	16 40	13 4	14 48	14 32	14 48	103	90

Although the results are somewhat uneven it must be remembered that last season was unusual as regards rainfall. No rain of any consequence fell until the third week in May, but such heavy rains were experienced after that that the ground soon became waterlogged.

Both the results of this year and the average results over the past 14 years are in favour of the plots cultivated in spring, after summer rains and before planting, though this year the increase does not appear to warrant the extra cost of so many cultivations.

FIELD EXPERIMENTS WITH WHEAT AT THE MERREDIN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.

J. LANGFIELD, Farm Manager.

In addition to the results already published in the March issue of the *Journal of Agriculture*, the following field experiments were conducted at the Merredin Experiment Farm last year—

- Depth of Ploughing Experiment
- Mulching Experiment
- Early or Late Fallowing Experiment.

The land upon which the experiments were conducted was typical Gimlet and Salmon Gum forest country.

The monthly rainfall recorded at the farm for 1928, together with the average for 17 years, is as follows:—

—	Jan.	Feb.	Mar.	Apl.	Growing Period. May	June	July	Aug.	Sep.	Oct.	Total May to Oct.	Nov.	Dec.	Yearly total.
1928 ...	39	...	101	58	76	107	224	154	71	19	651	...	24	873
Average 17 years	56	50	113	76	124	174	186	135	97	80	796	36	59	1 186

EARLY OR LATE FALLOWING EXPERIMENT.

The object of this experiment is to determine whether the time of fallowing has any effect on the resultant wheat crop on heavy forest land.

This is the fifth year that the experiment has been conducted.

Two plots were used, each half an acre in area, one-eighth of an acre of each being cut for hay and the remaining three-eighths of an acre harvested for grain. The early fallowed plot was ploughed during the first week of June and the late fallowed plot during the last week in August, 1927. A heavy disc implement was used, the land being ploughed to a depth of four inches.

The land ploughed in June turned over very well, but that ploughed in August was inclined to be hard and lumpy.

Both plots were cultivated with a springtyne implement during September, harrowed after rain at the end of March, cultivated with a disc implement in April and again with a springtyne prior to seeding.

The tabulated results are as follow—

TABLE A.

EARLY OR LATE FALLOWING EXPERIMENT.

PLANTED 25TH APRIL, 1928.

Variety—Nabawa. Seed—43lbs. per acre. Superphosphate (22%) 120lbs. per acre.

HAY YIELDS.

Date fallowed.	Computed yields per acre, 1928.	Percentage, 1928.	Average, 5 years.	Percentage, 5 years.
	cwts. qrs. lbs.		cwts. qrs. lbs.	
First week in June ...	31 0 16	100	37 0 6	100
Third week in August ...	29 2 16	95	31 1 14	85

GRAIN YIELDS.

Date fallowed.	Computed yield per acre, 1928.	Percentage, 1928.	Average, 5 years.	Percentage, 5 years.
	bus. lbs.		bus. lbs.	
First week in June ...	18 18	100	21 20	100
Third week in August ...	12 11	67	16 52	79

The results for this year and the average results for the past five years are strongly in favour of the practice of early fallowing both for hay and grain. Some of the advantages of early fallowing are—

1. Easier ploughing.

2. A better chance is afforded for the destruction of weeds.

3. More moisture is conserved in normal years by the longer period, thus providing a better insurance against dry spells at critical times.

4. Early fallowing renders it possible to work the soil down to a better tilth, resulting in an even and strong germination.

5. It stimulates the formation of nitrates and sweetens and aerates the soil.

6. Observations have shown that fallowing helps to check "Take-all."

7. Increased yields result. Over a period of five years the early fallow has given an increased yield of 5 cwts. 2 qrs. 20 lbs. for hay and 4 bus. 28 lbs. for grain per acre.

DEPTH OF PLOUGHING EXPERIMENT.

The object of this experiment, which has been conducted continuously for the past 14 years, is to determine the comparative effect upon resulting crops of ploughing the land to different depths. Three plots were required for the experiment and were ploughed as follows:—

Plot 1—4 ins. representing shallow ploughing.

Plot 2—6 ins. representing medium ploughing.

Plot 3—8 ins. representing deep ploughing.

The plots were each 1/8 acre in area and were repeated five times. The land, which had previously carried Salmon Gum and Gimlet timber, was ploughed to the different depths during June, 1927, with a disc plough. It was cultivated with a springtyne implement during September, harrowed during the first week in April after a fall of 84 points of rain and cultivated again with a tandem disc implement during the second week in April. Germination was good, but, owing to a dry spell, little growth was made during the first three weeks.

During the winter months the crop made excellent growth, but was checked by the dry spell in September. As a result, the ears did not develop normally and the grain was somewhat pinched.

The results are as follow:—

TABLE B.

DEPTH OF PLOUGHING EXPERIMENT.

PLANTED 25TH APRIL, 1928.

Variety—"Nabawa." Seed—43lbs. per acre. Superphosphate (22%) 120lbs. per acre.

Treatment.	Computed Yield per acre.										Average Yield, 1928.		Percentage Yield, 1928.	Percentage Yield, 14 yrs.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.	bus.	lbs.		
Ploughed— 4ins. deep	22	56	20	56	18	48	20	16	19	52	20	32	98	104
6ins. deep	23	28	21	4	21	28	19	12	20	24	21	4	100	100
8ins. deep	21	44	19	28	22	24	20	16	18	48	20	32	98	100

The yields obtained from the plots this year are again very even. Although the plots ploughed 6 inches deep show a slight advantage over those ploughed 4 inches deep, the average results for the past 14 years go to show that no advantage is to be derived from ploughing to a depth greater than 4 inches.

MERREDIN EXPERIMENT FARM.

MULCHING EXPERIMENT.

The object of this experiment is to determine how far and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer months. The land on which the experiment was conducted was ploughed in June 1927 to a depth of 4 inches.

Three plots were necessary and to meet the requirements of the experiment they were treated as follows:—

Plot No. 1.—Cultivated during spring, again when required during summer after 25 points of rain or over, and again prior to seeding, the object being to maintain a mulch throughout the fallowed period and to destroy weed growth.

Plot No. 2—Cultivated during spring and prior to seeding only (ordinary fallow).

Plot No. 3—Cultivated prior to seeding only (neglected fallow).

The land upon which the experiment was conducted was typical Salmon Gum and Gimlet timber country.

Plot 1 this year received a cultivation in December, this being the only occasion during the summer on which a serviceable rain was recorded.

All the plots were harrowed the first week in April after rain. They were then cross cultivated during the second week in April with a tandem disc and springtyne cultivated prior to seeding.

The germination was very irregular, but was better on plots 1 and 2 than on plot 3.

The results obtained are as follow:—

TABLE C.

MULCHING EXPERIMENTS.

PLANTED 30TH APRIL, 1928.

Variety—Nabawa. Seed—43lbs. per acre. Superphosphate (22%) 120lbs. per acre.

Treatment.	Computed Yields per acre.					Average Yield, 1928.	Percentage Yield, 1928.	Average Percentage Yield, 1915-28.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		
Mulched in spring, after rain during summer and before planting	15 4	18 32	18 0	20 24	17 12	17 52	111	103
Mulched in spring, and before seeding	15 4	15 20	15 52	16 32	17 44	16 8	100	100
Mulched before seeding only	14 40	14 24	14 56	13 36	15 36	14 40	91	95

The yield from the plot that was cultivated in spring, after rain during summer and prior to planting, shows an increase of 11% over the plot that was only cultivated in spring and prior to planting. This difference is greater than might have been expected in view of the fact that the former plot only received one cultivation during the summer, that being after a fall of 24 points in December.

Laboratory analyses of the soils of these two plots, carried out by Dr. Teakle in connection with his investigations of this problem throughout the growing period, showed little difference in moisture content. The plot cultivated through the summer had a slight advantage in nitrate content during the middle and later stage of the growing period, and because of this a slight increase in yield would be expected.

The percentage results for the past 13 years indicate that the general practice should be to cultivate the fallow during spring and again prior to seeding. In cases where the ground is weedy, this cultivation should be supplemented by additional cultivations after rain during the summer months. These not only destroy weed growth, but also assist to conserve moisture and control "Take-all."

MINERALS IN PASTURES AND THEIR RELATION TO ANIMAL NUTRITION.

J. B. ORR, D.S.O., M.C., M.A., D.Sc., M.D.
(Rowett Research Institute, Aberdeen, Scotland.)

(*A Review by H. W. Bennetts and L. J. H. Teakle.*)

This book, published by H. K. Lewis & Co., Ltd., London, 1929, is the result of inquiries of the Sub-Committee of Experts appointed by the Civil Research Committee of the Cabinet, Great Britain.

The search of the literature was carried out by Miss H. Scherbatoff, under the direction of Dr. Orr. The information obtained, supplemented by a fund of information acquired as a result of personal contacts with workers in all parts of the British Empire and throughout the world, has been published by Dr. Orr in the book under review.

As most farmers are vitally interested in the question, it has been deemed advisable to review briefly the information from the local aspect pending a study of the work itself by those sufficiently interested in this subject to secure it.

THE PASTURES OF THE EMPIRE.

The importance of the pastures of the Empire may be gauged from the fact that the value of the grassland products annually consumed in Britain amounts to £426,000,000. More than half of these are imported. Of the total value of exports from Australia, 60 per cent. is from grassland products.

These exports constitute a drain on the soil, and provision must be made to maintain or increase the supply of available soil minerals or malnutrition in animals will result, and assume increased proportions on account of mineral deficiencies in the pasture. It has been calculated that the soil of Victoria has been depleted to the extent of 360,000 tons of phosphoric acid during the last 60 years; 2,000,000 tons of superphosphate would need to be added to the soil to restore the pasture lands to the condition they were in about 1860.

MINERAL CONTENT OF PASTURES.

Pastures are not likely to be deficient in starches, sugars, proteins, etc., but the most frequent trouble is a deficiency in the mineral nutrients.

Diseases such as Pica (depraved appetite), coastiness, bush sickness in New Zealand, wobbles, rickets, etc., are often manifestations of a deficient mineral diet.

De Saussure, a Swiss, in 1804 published a book in which he showed that the ash of plants varied with the nature of the soil and the stage of growth of the plants. Later work was done in England, France, Germany and the United States of America, and there is now considerable reliable information on the mineral contents of pastures of recognised values for feeding purposes. It is found that good cultivated pasture contains approximately the same amounts of minerals as an amount of milk of equivalent food (calorific) value. Other foods differ markedly, and are usually deficient in one or more minerals. Thus wheat is particularly deficient in

calcium (lime) and sodium. Molasses is rich in all minerals except phosphate. This is shown in Table 1, copied from Table 3, page 11. The information in the table is of considerable value, not only to the investigator, but to the stockman who finds it necessary to supplement the natural food for his stock.

TABLE 1.

(Copied from Table 3, p. 11.)

COMPARISON OF MINERAL CONTENT OF GOOD PASTURE WITH THAT OF SOME OTHER FOODSTUFFS, WITH MILK AS A STANDARD.

1,000 CALORIES CONTAIN THE FOLLOWING AMOUNTS IN GRAMS.

	CaO. (Lime.)	P_2O_5. (Phosphoric Acid.)	Na_2O. (Soda.)	K_2O. (Potash.)	Cl. (Chlorine.)	N. Nitrogen.
Cows' Milk	2·38	3·43	0·81	3·21	1·4	8·32
Good pasture	3·64	2·75	0·94	11·54	3·5	10·40
Maize	0·03	1·83	0·13	1·36	0·001	4·64
Wheat	0·14	2·75	0·13	1·59	0·2	5·60
Potatoes	0 28	1·60	0·49	5·56	0·3	3·36
Turnips	1 18	1·06	0·33	5·40	0·42	3·87
Decorticated Cotton Cake ...	1·22	11 26	0·24	8·05	0·11	26·32
Molasses	5·35	0·56	1·02	10·26	3·56	4·23

It is not difficult to judge the quality of a pasture if it is carrying stock. The carrying capacity and the condition of the stock are infallible guides. It is found that there is a close correlation between quality and mineral content of pastures. This is shown by the extracts in Table 2.

TABLE 2.

(Abstracted from Table IV. p. 13.)

AVERAGE MINERAL CONTENT OF DIFFERENT TYPES OF PASTURE.

(PER CENT. DRY MATTER.)

Type of Pasture.	Ash. Silica free.	CaO. (Lime.)	P_2O_5. (Phosphoric Acid.)	Na_2O. (Soda.)	K_2O. (Potash.)	Cl. (Chlorine.)	N. (Nitrogen.)
Good cultivated (England and Scotland)	6·64	1·00	0·74	0·25	3·18	0·95	2·83
Good natural (England and Scotland)	5·85	0·65	0·67	0·37	2·66	0·64	2·50
Poor natural (England and Scotland)	5·49	0·56	0·60	0·41	2·60	0·60	2·54
Deficient (Island of Lewis) ..	...	0·29	0·24	0·38	0·68	0·12	1·34
Deficient (Falkland Islands) ...	4·56	0·29	0·54	0·31	2·20	0·70	1·95

The pasture from the Island of Lewis is deficient in both lime, phosphate and potash.

The Falkland Islands are deficient in lime. A stunting of the animals on these islands is, no doubt, due to the lack of lime in the pastures.

It is well known that top-dressed pastures are "sweeter," and that the stock prefer the grass to that which has not been treated. It is also found that stock prefer certain areas. Analysis shows that the pastures preferred are richer in minerals. Table 3 illustrates this fact.

TABLE 3.

(Abstracted from Table V., page 15.)

AVERAGE COMPOSITION OF SCOTCH HILL PASTURES.

(PER CENT. DRY MATTER.)

——	Ash. Silica free.	CaO. (Lime.)	P_2O_5. (Phosphoric Acid.)	Na_2O. (Soda.)	K_2O. (Potash.)	Cl. (Chlorine.)	N. (Nitrogen.)
Grass eaten	5·49	0·56	0·60	0·41	2·60	0·60	2·54
Grass not eaten	8·13	0·30	0·37	0·17	1·61	0·33	1·82

In certain areas pastures are deficient in individual minerals. Thus the Falkland Island pastures are deficient in lime. Australian and South African pastures are often deficient in phosphate. Data from various parts of the world are summarised in Table 4.

TABLE 4.

(Abstracted from Tables VIII., p. 19, p. 61, p. 63-4, p. 65, p. 92, p. 93.)

COMPOSITION OF PASTURES AS AFFECTING THE PHOSPHATE NUTRITION OF ANIMALS.

Locality.	Authority.	Type of Pasture.	Disease.	P_2O_5. (Phosphoric Acid) per cent.
Kenya Colony ...	Rowett Institute	... ...	... ...	0·19 to 0·82
Do	Orr	... ...	Malnutrition ... Normal ...	0·19 0·93
South Africa ...	Theiler et al ...	Natural	Styfsiekte ...	0·07 to 0·32
Australia: Victoria	Kincaid	Native	... ...	0·099 to 0·299
Victoria	Cherry	Tree grass ... Kangaroo grass ... Tussock	... ...	0·129 0·122 0·170
New South Wales	Henry	Natural	Osteomalacia ... Normal ...	0·28 0·56
Victoria	Audas	Grey bush— (Kochia pyramidala) ... ... Old Man Salt bush— (A. mummuluria)	... ...	1·48 1·28
Western Australia	Underwood ...	Good ... ... Poor	... ...	0·27 to 0·55 0·15 „ 0·28
Europe: Westphalia ...	Roloff	Meadow Hay ...	Brittle bone ... Normal ...	0·26 0·48
General	(22) ... ... (11)	Hay	Brittle bone ... Normal ...	0·26 0·52
Norway	Tuff	Hay	Osteomalacia ... Normal ...	0·17 0·50

The figures for *normal* pastures are underlined.

Of great interest are the figures for salt bush and grey bush, which contain about 5 to 10 times as much phosphate as do the natural grasses in Australia.

Deficiency diseases caused by lack of iron are known to occur in New Zealand, Scotland and Tasmania.

Lack of iodine is of importance in Canada and parts of Africa. Many other elements, manganese, boron, copper fluorine, aluminium, etc., are required in small amounts, and are obtained from the soil through the plant or drinking-water. No information is available to show the absolute requirements of the elements.

FACTORS AFFECTING MINERAL CONTENT OF PASTURES.

The content of minerals in pasture and, therefore, the value of the pasture in the mineral nutrition of the grazing animal, depends on—

1. Species of plants.
2. Stage of growth of plants.
3. Climatic conditions.
4. Nature of the soil.

Species of Plant.—The legumes are generally richer in minerals than are the grasses, and this applies in particular to lime and sulphur. The ash of grasses is relatively richer in phosphates when compared with legumes. The sulphur content of legumes, particularly lucerne, is of significance in wool production. The value of mixed pastures is evident as the different types of plants supplement each other, and there is less danger of deficiencies.

TABLE 5.

(Abstracted from Table 16, p. 34.)

PER CENT. DRY MATTER.

—	K_2O. (Potash.)	CaO. (Lime).	P_2O_5. (Phosphoric Acid.)	SO_3. (Sulphuric Acid).
Timothy	1·55	0·11	0·40	0·19
Clover	2·10	1·50	0·40	0·23
Lucerne...	2·25	1·76	0·56	0·40
Vetch	2·06	1·12	0·58	0·24

Seasonal Variation and Stage of Growth.—In general, it is found that young vigorous plants are richest in minerals. As they reach maturity and produce seeds the mineral contents decline as certain of the minerals, particularly phosphate and nitrogen, migrate to the seed. After the fall of the seeds the pasture is of poor quality, and usually deficient as a food. Recent studies by Sir Arnold Theiler and co-workers in South Africa (summer

growing season) show the marked change in mineral composition with season and maturity.

TABLE 6.

(Abstracted from p. 80.)

COMPOSITION OF DRY MATTER OF GRASS AT ARMOEDSVLAKTE.
PER CENT DRY MATTER.

Date of Sampling.	Protein.	Ash.	P_2O_5.	CaO.
November	19·4	11·6	0·60	0·31
December	14·3	7·7	0·32	0·59
January	13·8	7·7	0·22	0·50
March	7·2	5·9	0·24	0·43
April	4·9	6·1	0·11	0·43
May	4·1	5·9	0·07	0·50
June	4·0	7·2	0·09	0·59

This means that mineral supplements may be required in certain seasons and not in others. Analysis of the pasture must be undertaken to determine the mineral needs at different seasons.

Climatic Conditions.—Drought seriously affects the mineral content of pastures; in particular, phosphate absorption is seriously reduced. This means that in periods of drought, or semi-drought, the feed is not only less abundant, but also of poorer quality.

Nature of the Soil—Application of Fertilisers.—De Saussure, a century and a quarter ago, established the fact quantitatively that the ash content of plants differed in different soil types. Later it was found that fertilisers affect both the quantity and quality of herbage. In Western Australia pasture production is at least doubled as a result of superphosphate dressings, and the quality is improved. Richardson, in Victoria, found the following effects as a result of additions of fertilisers on a poor soil.

TABLE 7.

(Reproduced from page 45.)

EFFECT OF FERTILISERS ON YIELD AND MINERAL CONTENT OF HAY IN VICTORIA.

Fertiliser.	Hay.	Composition of Herbage per cent. dry matter.		
		Nitrogen.	P_2O_5. (Phosphoric Acid).	CaO. (Lime).
	cwts.			
No manure	23·2	1·46	0·27	0·60
1 cwt. superphosphate ...	43·7	2·28	0·59	1·47
1 cwt. superphosphate, plus 10 cwts. lime	62·1	2·20	0·46	1·44

On good soils, well supplied with phosphate, phosphatic fertilisers generally do not increase the phosphorus content of the herbage. On the poorer soil types not only is the chemical composition of pasture altered by fertiliser additions, but the botanical composition is changed. Leguminous plants are especially favoured by lime and phosphates, and a higher ratio of legumes means a higher ash content in the pasture.

CONDITIONS UNDER WHICH DISEASES DUE TO DEFICIENCY OF MINERALS IN PASTURES OCCUR.

"The mineral requirements of young animals depend upon their rate of growth."

The composition of milk is an indication of the requirements of the young animal of a particular species, and it has been shown that the milk of quick-growing animals is richer in minerals than that of slow growers. For example sow's milk contains approximately four times as much mineral as is found in human milk.

Improvement of breed (increased rate of growth) has usually been associated with improvement of pasture. If these improved breeds are introduced on to poor unimproved pastures (as in new countries), or on to old pastures which have been depleted in minerals by continuous grazing of animals with removal of animal products, milk, bones, etc., without compensating return of minerals to the soil; deterioration of breed results. The mortality rate also is increased.

The grading up of native stock with consequent increased mineral requirement must be correlated with grading of pastures, or trouble will result.

DEFICIENCY DISEASE IN GRAZING ANIMALS.

Much space is devoted to this question, but in this short review it is only possible to mention points which will be of special local interest.

Mineral deficiency of pasture may be so extreme that actual disease results, or, of such a degree that though no actual disease results the feeding value of the pasture is affected, with lower animal production.

The diseases due to mineral deficiencies in different parts of the world fall into definite groups.

1. *Those due to deficiency of phosphorus*—

   "Styfsiekte" in South Africa.

   "Coastal Disease" in Australia.

   "Dry Bible" or "Impaction Paralysis" (Carrion poisoning) in Australia and Tasmania; and "Lamsiekte" in South Africa are due primarily to phosphorus deficiency.

2. *Those due to deficiency of lime*—

   "Osteoporosis" or "Big Head" in horses. (Said not to be very common in Australia.)

3. *Those due to deficiency of iron—*

"Bush Sickness" in New Zealand, and a similar condition in King Island. (Cattle and Sheep.)

"Pining," a condition affecting sheep in Scotland.

This group is characterised by progressive anaemia and emaciation.

Diseases which are attributed to deficiency of either phosphorus or calcium in pasture are common in all States of Australia. A group of similar diseases known by various local names, "Coastal disease," "Cripples," etc., associated with unthriftiness, pica (depraved appetite), and the changes in the skeleton—soft bones, swollen joints, stiff gait, etc., are included here. These conditions resemble the "Styfsiekte" of South Africa, the primary cause of which has been shown to be phosphorus deficiency.

The condition known variously as "Dry Bible," "Impaction Paralysis" (Carrion poisoning) is a very common one in Australia, and is most probably the same disease as "Lamsiekte" of South Africa. This latter disease has been shown by Theiler to be primarily due to phosphorus deficiency. In both diseases the deficiency results in "Osteophagia" (bone chewing) in case of cattle, and sometimes sheep. The paralytic symptoms which sometimes follow this habit are due, as has been shown by Seddon in Australia and Theiler in South Africa, to the ingestion of poison of germs (Botulinus group) contained in some of the bones or carcases of animals which have been eaten.

(Note.—This disease has been described in this Journal in two articles dealing with "Toxic Paralysis" of Cattle and Sheep.)

The Osteophagia and consequent disease are prevented by feeding of phosphate-rich minerals such as bone meal. This treatment is also claimed to have a preventative influence on worm infection, and on some forms of sterility and abortion, now known to be due to mineral deficiency. The prevailing view is that there is a marked phosphate deficiency in the soil generally in Australia, and that this is "the chief root of evil of these deficiency diseases in stock." There is much evidence to support this view.

Soil analyses in Australia have shown that there is a marked phosphorus deficiency in soil in "bone chewing" areas. It has also been shown that Australian native grasses have a lower phosphorus content than the same kind of grass grown in Europe.

The almost universal response of vegetation to applications of superphosphate in Australia is also evidence of deficiency of phosphorus.

It is interesting to note that "salt bushes," which are known to have a marked beneficial effect on the health of stock have been found, on analysis, to be rich in phosphate and lime.

The rate of growth of horses is slower than that of cattle and sheep, so that diseases due to mineral deficiency are not so common in the former animal. The breeding and rearing of horses with good bone and stamina is, however, only successful in districts where pastures are rich in bone-forming elements. If horses are transferred to poor pasture the breed deteriorates as is said, by Cameron, to occur in English racehorses imported into Australia. This deterioration of progeny is attributed to phosphate deficiency in pastures.

INCREASED PRODUCTION AS A RESULT OF MINERAL FEEDING.

The diseases resulting from mineral deficiencies in pasture may be prevented—

1. By direct administrations of required minerals to the animal.
2. By enriching of pastures through mineral applications.

1. *Direct Administration.*

Sodium Chloride (common salt). The beneficial effect of feeding salt to stock has been known for centuries. In a hot climate a generous allowance is required, as much salt is lost with perspiration.

Lime and Phosphate.—The beneficial effect of feeding bone meal (supplying phosphate, lime and traces of other minerals) to stock depastured on phosphate-deficient country has been strikingly demonstrated by Theiler and others in South Africa.

(a) Increase in weight. The following table illustrates the increase in weight in young growing cattle fed bone meat at rate of 3oz. per day per head. Similar cattle grazing on the same pasture received no bone meal.

Increase in weight in lbs.—

	Bone Meal.			Nil.	
	No. 518.	No. 502.		No. 475.	No. 528.
Increase in weight in lbs. ..	445	442	..	146	154

(b) Increase in carcase value. The cattle fed on bone meal had more meat and fat in proportion to skeleton and entrails than those receiving no bone meal.

(c) Increased milk yield. Cows, on same phosphorus-deficient area, to which bone meal was fed showed a 40 per cent. increase in milk production, compared with controls receiving no bone meal.

(d) Increased resistance to disease. There was a decrease in mortality from disease generally in bone meal fed groups, as compared with controls which received no bone meal.

The above results illustrate the fact that preventative measures taken against mineral deficiency diseases result in increased growth and production in animals.

2. *Increasing Mineral Content of Pasture.*

Practically all pastures are capable of improvement as regards mineral content. This content can be increased by suitable mineral applications to the soil, and is followed by beneficial effects on stock. Both the yield and carrying capacity of pasture on cultivated lands are increased.

Of the two methods of increasing the mineral intake of grazing animals, the indirect method, viz., the application of mineral fertilisers to the soil is the better, because in addition to enriching the pasture in mineral nutrients it increases its feeding value in other ways.

In Australia the carrying capacity in some districts has been more than doubled by this method. Unfortunately, however, the improvement of Australian pastures tends to be accompanied by a deterioration in quality of wool, the resultant larger framed sheep carrying stronger wool.

One may conclude with a quotation from the book which sounds a note of warning, and at the same time illustrates the urgent need for research in this State.

> "Before administering mineral salts to grazing animals it is necessary to determine whether or not the pasture on which they are grazing is deficient, and, if so, the nature of the deficiency. The only method of determining this is by chemical analysis of the pasture."

SUMMARY.

1. Good cultivated pasture on which grazing animals thrive is rich in mineral nutrients, the amounts and proportions of these being similar to those found in cow's milk, when reckoned on the basis of equal calorific value.

2. Natural pastures are, as a rule, poorer in minerals; hence the general inferior feeding value of natural pastures.

3. Poor pastures may be generally deficient in minerals or deficient in one or other of the necessary minerals. The mineral content of pasture is affected by the species of plants, the season and stage of growth, climatic conditions—drought, and the nature of the soil—with or without fertiliser treatments. Pastures containing a variety of plant types are less likely to be deficient in feeding value than if one type of plant only is grown.

4. Australian pastures generally are deficient in phosphorus. Other deficiencies may occur, but are of less importance.

5. Deficiencies in iron, lime and iodine as well as phosphorus are known to occur in various parts of the world where stock are grazed.

6. Grazing of natural pasture invariably leads to soil exhaustion and a decline in feeding value of the pasture.

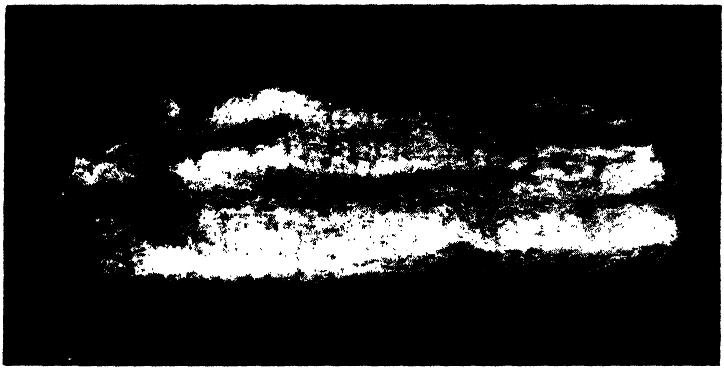
7. Top-dressing to supply the soil deficiencies is the best means of maintaining or improving the value of pastures.

8. Under pastoral conditions, feeding supplements in the form of mineral licks is the only economic way to supply the required salts. The nature of the deficiency should be ascertained before attempting to feed anything in the nature of a mineral mixture. This can be done only after a systematic examination of the pastures. The examination should be undertaken on representative soil types and at the different growth stages of the plant.

VARIATIONS IN WOOL FIBRE.

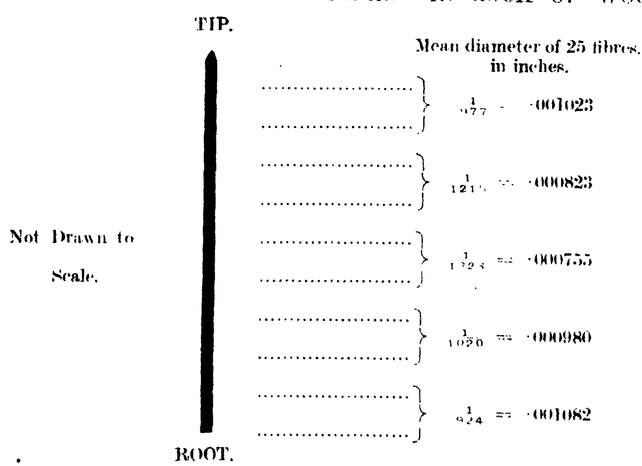
DUE TO VARIATIONS IN PASTURE.

During a visit to Bradford last year, Mr. E. H. B. Lefroy of Cranmore Park and the Boolardy Pastoral Company raised the question with Dr. Barker, the Director of Research at the British Research Society for the Woollen and Worsted Industries, as to whether, during periods of stress, the diameter of the fibre of the wool became less and the crimp smaller. No definite information was then available on this subject, but on Mr. Lefroy's return to Western Australia, a sample of wool was sent to Dr. Barker at Bradford, who passed it on to Professor Barker at the University of Leeds. A microscopical examination of the fibre was made and the following measurements and photographs supplied to Mr. Lefroy who has kindly made them available for publication as being of interest to sheep raisers.

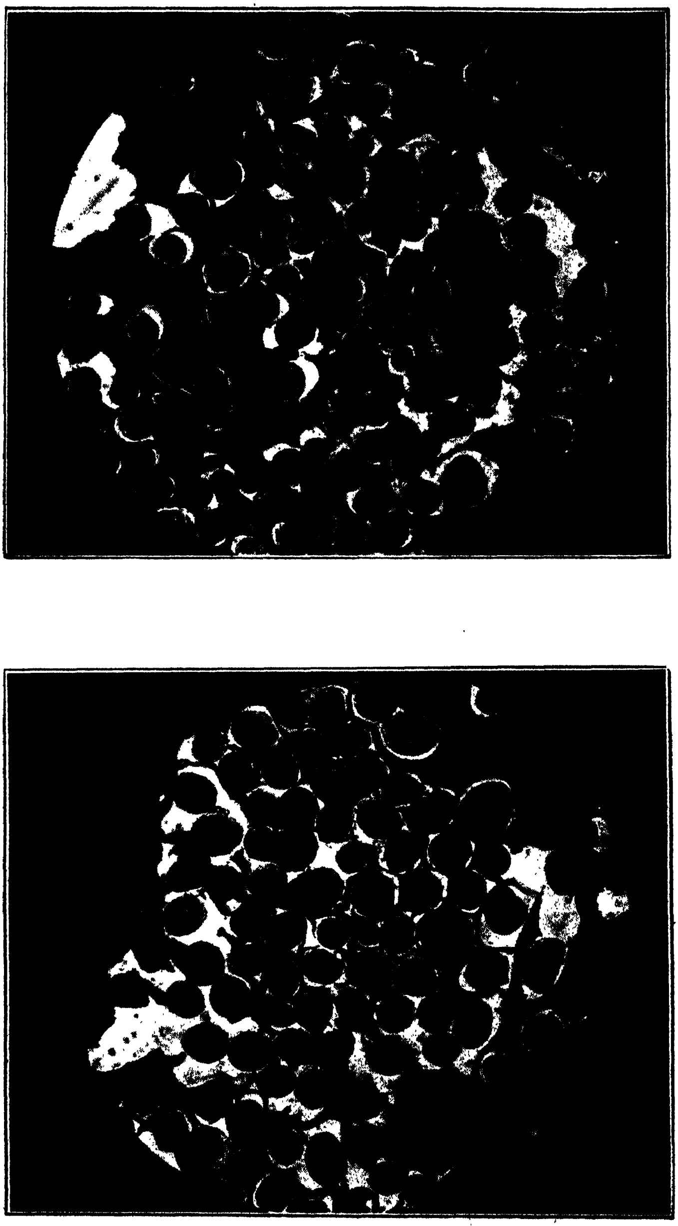


Sample of wool from the Boolardy Pastoral Company.

DIAGRAM OF DIAMETER ALONG FIBRES IN LOCK OF WOOL.

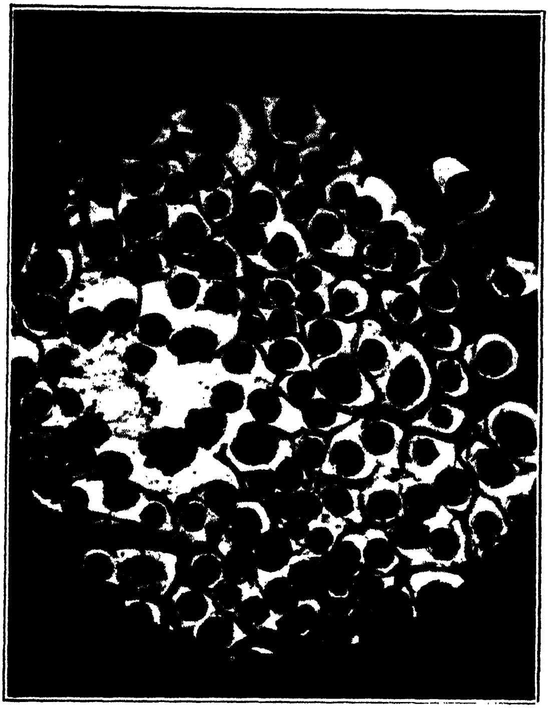


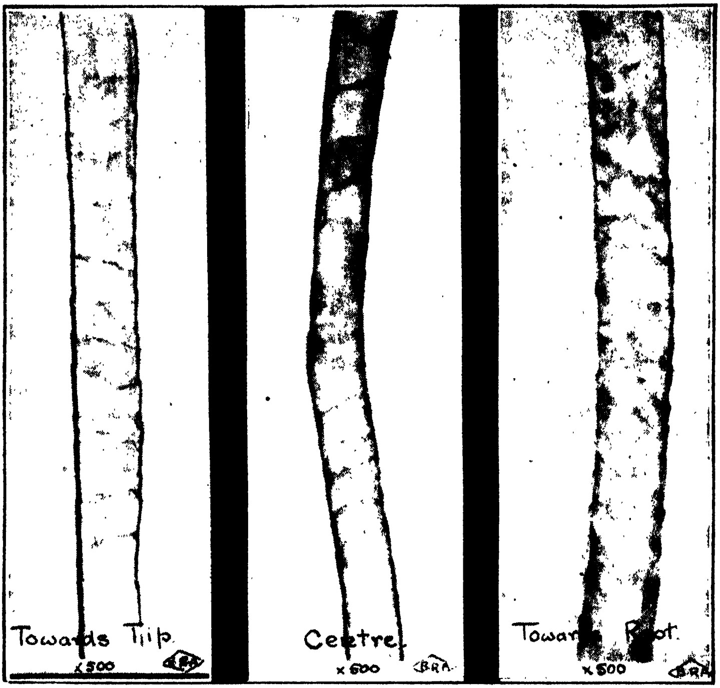
It is obvious, both by inspection and actual measurement, that there is considerable variation of diameter along the fibres of the sample lock, and that a thinner or finer portion exists in the centre portion of the lock. The tip is finer also than the root.



Micro-photographs: Transverse sections of wool fibres, showing variations in thickness.

Micro-photographs: Transverse sections of wool fibres, showing variations in thickness.





Micro-photographs of same wool fibres, showing variations in thickness towards tip, centre, and root.

MEASUREMENTS ON SAMPLE LOCK OF WOOL.

CROSS SECTIONAL MEASUREMENTS (Mean of 50 Fibres).

Part of Lock.	Cross sectional area in square inches.	Circularity Ratio.	Crimps per inch.
Root	$\frac{1}{67567}$ = ·0000148	1·150	8·6
Middle	$\frac{1}{117647}$ = ·0000085	1·114	11·1
Tip	$\frac{1}{83333}$ = ·0000120	1·160	8·8

GEO. L. SUTTON.

CURCULIO BEETLE.

(*Otiorynchus cribricollis.*)

A. FLINTOFF.

Among the insect pests with which orchardists in Western Australia have to contend, there is one that has, of late, come specially into prominence in the fruitgrowing areas of the South-West. This is commonly known as the "Curculio," and is a night-feeding beetle. As there are numerous beetles having similar characteristics and of varying sizes, it would be well for orchardists not familiar with the particular kind dealt with herein to forward any specimens of which they are doubtful to Mr. Newman, Government Entomologist, for identification. This officer is now actively engaged in tracing the life history of the Curculio Beetle, the habits of which are, in some stages, rather obscure. Until further knowledge of the life cycle is obtained, it is proposed here to give a record of observations as to the general form and habits of this pest, also a resumé of the work carried out during the present season for its control.

DESCRIPTION AND HABITS.

The beetle under review is a true weevil with full body tapering somewhat toward the head, about three-eighths of an inch in length, and of uniform colour, light to dark brown. It is a night-feeding beetle operating above ground from November to March or April, according to climatic conditions. The effect of its work is easily distinguishable, as it does not feed voraciously like the caterpillar and grasshopper, but more or less evenly serrates the leaves around the edges. It also nibbles the bark from stems of fruit, often completely ringing them, and damages fruit spurs and laterals in the same way. It will be further noticed that leaf stems are so bitten that the leaves either fall or hang loosely. Much damage is also done to fruit where such is clustered, forming a secluded hiding place, the beetles often remaining in these recesses during the day to again renew their depredations at nightfall. So far as is known this beetle, in the adult or summer stage, does not feed on the roots of trees or plants, confining its attention to over-surface vegetation: hence in our efforts toward control we should pay particular attention to keeping the orchard free from weeds during summer.

CONTROL.

So as not to appear in any way an alarmist I would point out that the beetle under review has been known in some orchards in the South-West for more than 20 years, and those orchards are still bearing good crops of fruit. It was found, however, that damage of more or less severity was done every year, and methods of control have been practised with results proportionate to the care taken. This season the pest has shown up in plague form, and the damage has been such that growers whose orchards have been affected are obliged to consider it of more than secondary importance.

As the control of each pest adds considerably to the cost of production I would urge growers to confer and decide on some uniform and econ-

omic method of control and prevention, for it is obvious that generally unchecked distribution would be a serious setback to fruitgrowers.

Many attempts have been made to destroy the Curculio Beetle, and some orchardists have been successful in so checking its inroads as to consider any damage done as negligible.

Perhaps the first recorded effort to control Curculio was that of Mr. G. W. Hester, of "Dalgarup Park," Bridgetown, who noticed the beetle entangled in sheep's wool. The idea occurred to him that a band of wool around the tree trunk would prevent ascent. The plan was only partially successful, as if the wool was not fleecy the insects could crawl over the band, and only a percentage become entangled. Recently the same orchardist tried a wool band, with wool about six inches in length, the band being affixed in such a way that the wool draped over in umbrella form. This proved very satisfactory.

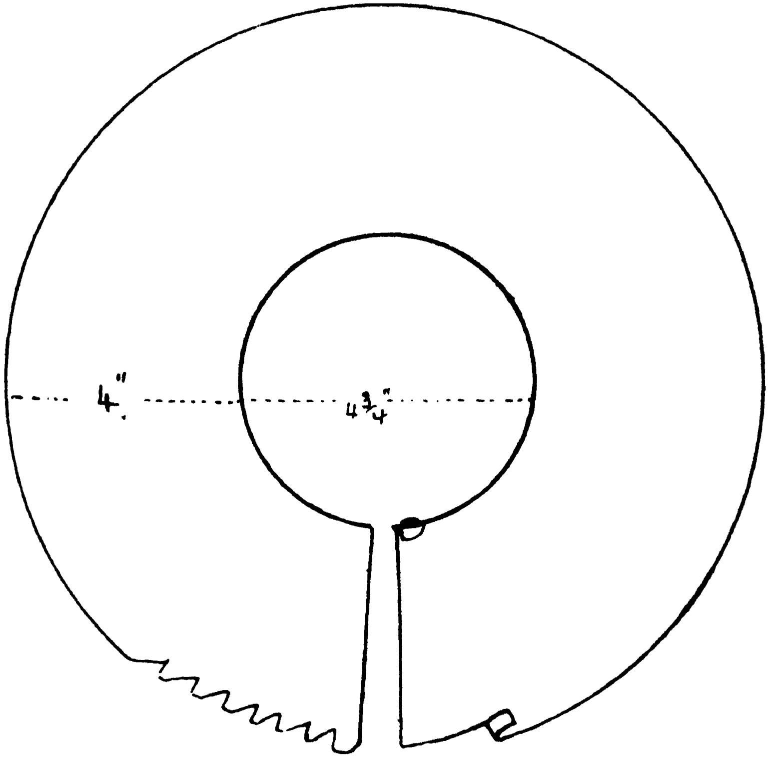
Poultry.—A striking example of successful control with poultry may be found in Mr. V. R. Johnston's orchard, "Cascades," Greenbushes, where the owner has fought the pest for years, trying out many methods, including poison bait, metal bands, etc. At length being convinced of the efficacy of poultry for the purpose of control, he set to work on the basis of ten fowls per acre, and has so perfected his plan as to be able to keep some 300 head continuously working in the orchard during the spring and summer months. Whether or not poultry would prove generally successful is a debatable point, and the efficacy of such a method would depend largely on the amount of care and enthusiasm of the individual orchardist.

Control by means of poultry as has been shown is successful, but requires an amount of concentration which the average orchardist may find irksome. In the first place one requires to arrange for the housing, feeding and watering of the birds in various parts of the plantation. With orchards up to five acres the one depot would suffice. Fowls of a foraging type should be used. Then from an economic view point it is obvious that the flock should be renewed every second year, and provision made for marketing eggs and birds so that the cost of installation and upkeep would, at least, be defrayed. Undoubtedly poultry, under right conditions, thrive, as the beetle is good food and, when finished feeding on the tree, return before morning to the ground, locating just beneath the surface soil, mostly near the tree trunk, thereby proving an easy victim to the active bird.

Wool Bands.—The present method of applying wool bands is to cut a strip of long wool sheep skin about one inch wide and affix to trunk of tree in such a manner as to prevent ascent except by traversing the fringe of wool. The beetle tries to do this, but the claw-like feet become entangled in the fine wool. I have seen upwards of 500 caught in this way. The Curculio does not fly, therefore, if this band is placed so there are no gaps, it proves an effective trap and, although a few do manage to get across, the damage done the tree, in any case, would be small. The cost of material would approximate 2d. per average sized tree, and might require renewal each year.

Care must be taken to ensure that the skin side of the wool band does not come in contact with the tree, as the oil in the skin will cause damage.

Poisonous Sprays.—Arsenical sprays have been used with good results, but the practice cannot be recommended as it would necessitate the tree being treated during January, February and March, having the effect of coating the fruit prior to picking, with a poisonous substance, the strength of which (1lb. of arsenate of lead paste to 8 gallons of water) would prevent its being exported. The cost of treatment would also be comparatively high. I would, however, recommend the poison spray for young, non-bearing trees which may be awkward for banding.

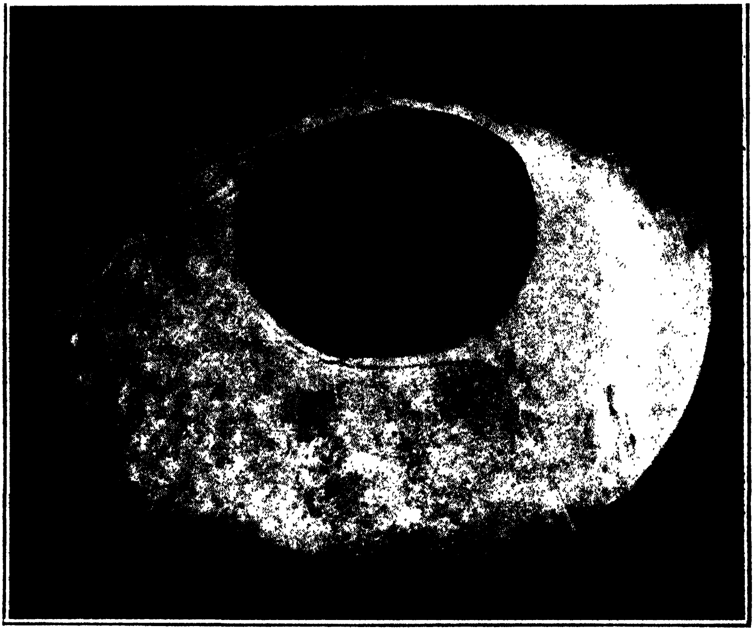


Pattern showing how band is cut from sheet of plain metal.

Poison Gas.—Bi-sulphide of carbon or other volatile poisons are also used, and as is well known to agriculturists, if applied so that the fumes impregnate the soil where insects are hiding, great numbers may be destroyed. So far, this method has not been tested out thoroughly, and the cost may, here again, be prohibitive if applied in sufficient quantity to effect control.

Metal-banding.—A method of control by banding with a strip of metal so placed on the trunk of tree as to stand out at an angle of about 45 degrees, and fitting close to the bark at the top, has been found effective. The band is cut from light galvanised flat iron, and the approximate cost of material per tree—fourpence—and would not require renewal unless damaged by

rough usage. In the early stages of experiment it was found necessary to increase the width of band to at least four inches, as a small percentage of beetles managed to cross narrower bands. To avoid the necessity of making a special band for each tree a series of notches, as shown in the illustration herewith, are cut on the outer edge with a simple catch for tightening, or removal at any time without undue waste of time. This arrangement permits of a stock size being used for tree trunks, varying two inches in circumference. The efficacy of this band is undoubted, as trees on which they were placed in December last remain free from injury while adjoining unbanded trees are severely damaged. Of course it will be understood that to prevent the weevil climbing up between the band and the tree trunk it is essential to first place a piece of sheep skin or bagging round the tree underneath the band.



Metal Band—Closed.

Recently photographs of banded and unbanded trees were secured, and although the full extent of the damage to the unbanded trees is not shown in the illustration, some idea of the benefit derived from the use of the band may be gained from a comparison of the two illustrations hereunder. As "metal banding" prevents the beetle climbing the tree, but does not destroy it, a poison bait lure has to be considered in conjunction, and it is suggested that a few leafy twigs or laterals of apple or other fruit tree be dipped in a poisonous solution and placed at the foot of the tree so that the Curculio, finding its food supplies cut off, will be attracted to the bait.

A grateful acknowledgment is made to those growers who co-operated in these experiments and assisted to bring them to a successful conclusion.

Banded tree in foreground showing prolific growth.

Showing trunks with metal bands on them.

Close view of unbanded tree adjacent to banded tree showing damage by Curculio.

DISTRICT CHALLENGE WHEAT YIELDS COMPETITION.

I. THOMAS, Superintendent of Wheat Farms.

The conditions governing this competition are:—

1. The competition is to be for a period of three years. The contestants are not individual farmers, but teams of five farmers belonging to the same district.

2. No farmer shall be eligible for inclusion in a team unless the area harvested by him for wheat grain each and every year during the competition is not less than 200 acres. The whole of the wheat crops on the farm are to be judged in this competition, and where the competitor has more than one farm in the same district, the total areas are to be treated as one entry.

3. A farm shall be deemed to be within a particular district when, in the opinion of the Director of Agriculture, such farm is within the zone of influence of the society nominating the team.

4. The awards are to be based on yield only, and the team of five which obtains the best average yield per acre for the three years, during which period the competition is held, shall be adjudged the winner. In the event of two or more teams securing the same average yield for this period the competition will be extended as far as these two teams are concerned until the average yield of the one over the whole period exceeds that of the other.

5. The method of judging to be as follows:—The judge is to visit the farm of each competitor, and at a convenient time measure up the stripping area and ascertain the quantity of wheat on hand. On or before January 31st the farmer will be required to furnish the judge with a sworn declaration as to the quantity of wheat sold from the competing holding, and the amount retained for seed and other purposes. The statement regarding the amount sold is to be supported by agents' dockets. The judge will satisfy himself as to the correctness of this statement, and from the information obtained compute the average yield per acre.

6. The judge shall be appointed by the Director of Agriculture and the judge's decision shall be final.

7. Nominations for this competition will be received by the Royal Agricultural Society not later than 15th October, 1928. On or before 1st November of that year, and during each succeeding year of the competition, the societies must submit the names of the farmers representing the district in this competition. If, through misfortune, any farmer nominated is unable to compete, a substitute may be nominated at any time prior to the completion of the judging in that district. Each year nominations must be accompanied by a fee of 25s. for each team.

The trophies have been presented for competition by the Cuming Smith and Mt. Lyell Farmers' Fertilisers Company, Ltd. The first and main trophy is a Challenge Shield which is valued at 20 guineas. On the completion of the competition this shield will become the property of the district society or association nominating the winning team of five farmers. On the shield will be recorded permanently the name of the winning society and the names of the farmers comprising the team. In addition the names of the districts who win it in any particular year, together with the names of the individuals comprising the team from that district that year will be shown. In addition to this shield the fertiliser companies are presenting the members of the winning team with a small replica of the shield on which will be inscribed the name of the district winning the yearly competition and each member of the team.

The judging of this, the first competition, was carried out by the officers of the Wheat Branch.

The results are as hereunder, the competing teams being placed in order of merit.

DISTRICT CHALLENGE SHIELD WHEAT YIELDS COMPETITION, 1928–29.

District.	Members of Team.	Acreage.	Yield. Gross.	Yield. Average per acre.	
			bushels.	bus.	lbs.
Yandanooka	Neville, P. C.	313	9,900	31	38
Do.	Saunders, W. S.	238	6,760	28	24
Do.	Eckerman, H.	255	6,452	25	18
Do.	Duff, T	302	7,176	23	46
Do.	Wick, E. F.	291	6,490	22	18
		1,399	36,778	26	17
Gnowangerup ...	Davis, N. P.	337	9,952	29	32
Do.	Parkinson, A. W. ...	243	7,123	29	19
Do.	Garnett, J.	200	5,482	27	25
Do.	Johnson, A.	332	8,093	24	23
Do.	Chambers, E.	292	6,177	21	9
		1,404	36,827	26	14
Borden	Milne, M.	257	6,978	27	9
Do.	Bungey, R.	332	8,200	24	42
Do.	Murray, W.	201	4,900	24	23
Do.	McLennan, W.—Estate of	215	5,220	24	17
Do.	Moir, J.	200	4,197	20	59
		1,205	29,495	24	29
Three Springs ...	Bastian, A.	283	6,953	24	34
Do.	Glyde, K. S.	328	6,806	20	45
Do.	Thomas & Sons	567	11,692	20	37
Do.	Carter, R., & Sons ...	353	6,297	17	50
Do.	Broad, A. F.	605	9,524	15	45
		2,136	41,272	19	19
Kellerberrin ...	Lowe Bros.	400	9,153	22	53
Do.	Hammond, J. D.	305	6,426	21	4
Do.	Gibbs, R.	371	6,947	18	44
Do.	Southerland, B. & D. I.	563	10,103	17	57
Do.	Nicholls, H.	567	9,162	16	10
		2,206	41,791	18	56
Kulin	Henderson, J. H. ...	578	13,180	22	48
Do.	Johnson & Murray ...	404	8,202	20	18
Do.	Trotter, A. W.	409	7,002	17	7
Do.	Nichols, R.	669	11,148	16	40
Do.	Howe Bros.	321	4,923	15	20
		2,381	44,456	18	40

DISTRICT CHALLENGE SHIELD WHEAT YIELDS COMPETITION—*contd.*

District.	Members of Team.	Acreage.	Yield. Gross.	Yield. Average per acre.
			bushels.	bus. lbs.
Lake Grace	Stevens, F.	273	6,677	24 28
Do.	Woodburne, J.	406	7,560	18 37
Do.	Coad, J.	410	7,555	18 26
Do.	McMahon, P. J.	427	6,622	15 30
Do.	Darby, A. H.	299	4,213	14 6
		1,815	32,627	17 59
Moulyinning ...	Wilson, A. F.	415	8,715	21 0
Do.	Hornsby, K. & S. ...	250	5,134	20 32
Do.	Clark Bros.	289	4,767	16 30
Do.	Mott, C.	461	7,517	16 19
Do.	Elder, A.	429	5,960	13 54
		1,844	32,093	17 24
Ogilvie	Lawrence, H. N.	383	8,590	22 26
Do.	Atkinson, A. G.	468	9,156	19 34
Do.	Hollis & Browne ...	425	7,458	17 33
Do.	Horan, A.	969	15,160	15 39
Do.	Carson, P.	825	11,889	14 25
		3,070	52,253	17 1
Bruce Rock ...	Mann, R.	543	9,620	17 43
Do.	Haggerty, H. J.	333	5,724	17 11
Do.	Stone, S. B.	540	9,170	16 59
Do.	Abraham, J. M. R. ...	665	10,165	15 17
Do.	Tibbs, J. A.	318	4,821	15 10
		2,399	39,500	16 28
Tammin	Uphill, G.	963	16,644	17 17
Do.	Mann, J. W.	378	7,306	19 19
Do.	Thomson, M.	621	9,994	16 6
Do.	Machin, C. C.	829	11,560	13 57
Do.	Hocking, A.	385	5,718	14 51
		3,176	51,222	16 8
Corrigin	Sainsbury, C. W. ...	274	4,920	17 57
Do.	Crossland, J. L.	791	13,899	17 34
Do.	Bremmer, J. R. & Sons...	1,124	16,839	14 59
Do.	Cronin, J.	671	9,585	14 17
Do.	Overheu, W. P.	651	9,302	14 17
		3,511	54,545	15 32
Nungarin	Williams, F. A.	483	8,042	16 39
Do.	Dawe, A. F. H.—Estate of late	290	4,738	16 20
Do.	Creagh Bros.	916	14,141	15 26
Do.	Warner, F. L.	627	8,741	13 57
Do.	Payne, H. G.	518	6,113	11 48
		2,834	41,775	14 44

DISTRICT CHALLENGE SHIELD WHEAT YIELDS COMPETITION—*contd.*

District.	Members of Team.	Acreage.	Yields.		
			Gross.	Average per acre.	
			bushels.	bus.	lbs.
Kukerin	Gard, T.	251	3,857	15	22
Do.	English, C.	808	11,688	14	28
Do.	Smith, J.	256	3,221	12	35
Do.	Harrison, W.	249	2,991	12	1
Do.	Ditchburn, R.	488	5,363	10	59
		2,052	27,120	13	13
Doodlakine, No. 1 ...	Fisher, A. J.	271	4,428	16	20
Do.	Mableson, H.	646	10,289	15	56
Do.	Spillman, D.	840	12,329	14	41
Do.	Spillman, J.	1,069	10,073	9	26
Do.	Birch, F.	639	5,506	8	37
		3,465	42,625	12	18
Mt. Marshall ...	Cook Bros.	372	5,178	13	55
Do.	Shemeld, H. G.	498	6,867	13	47
Do.	Shields, L. M. N. ...	502	6,250	12	27
Do.	Purdom, P.	743	8,633	11	37
Do.	Green, A. E.	1,120	11,648	10	24
		3,235	38,576	11	55
Bunketch-Burakin ...	Davis, J. B.	555	8,566	15	26
Do. ...	Thompson, W. E. ...	354	4,629	13	5
Do.	Knapp, H. ...	399	5,028	12	38
Do.	Thompson, R.	581	5,847	10	4
Do.	Roche, J. J., & Sons ...	957	9,432	9	51
		2,846	33,502	11	46

THE FUR RABBIT.

C. J. CRAIG.

Any mention of a new wool bearer instantly commands the interest of Australians. The French breed of rabbit was first mentioned in England when Louise, Duchess of Portsmouth, a favourite of the Merry Monarch, brought over some pets which a chronicler of the time referred to as "monstrous furry creatures."

Probably few of our readers realise the immense hold which the domesticated rabbit has obtained on the fur markets of Great Britain, France, United States, etc. Not only does it supply a far larger proportion of the furs offered than any other animal, but it is steadily reducing the number of its competitors by the strange process of producing almost exact copies of their furs at far more moderate prices. The Chinchilla rat at £20 came into competition with the Chinchilla rabbit at 15s., and disappeared. The marten has met with the same fate, the sable seems likely to follow suit, and now it appears that "Brer Fox" is seriously challenged by his old adversary. New types of rabbits are constantly being evolved, but by far the most remarkable of recent successes is the "Chifox," which was exhibited at a rabbit show recently opened at Westminster by the Minister for Agriculture.

For twelve years Mr. Milsum, a well-known breeder, has been aiming to produce a fur between that of the more costly varieties of fox and the Siberian hare. His success is demonstrated by the appearance of the Chifox, which is described as a rabbit with a long, dense fur of great beauty especially suitable for trimmings. The Chifox can be produced in any one of seven fixed natural colours, viz., grey, white, squirrel, sable, silver-backed, smoke beige, and blue. The pelts extend to 19in. when dressed. Another novelty at the same show was the "Chinchillarex," which is a much improved Chinchilla with a coat so close-haired as to be almost velvety in texture, and from which the long "guard-hairs" which have to be pulled out before an ordinary fur is made up, have been completely eliminated by scientific breeding. The official report complains that "such rabbits are too expensive, costing as much as £15 a live rabbit, to be used for pelting," but probably the breeders are not dissatisfied. There are, unfortunately, no statistics obtainable regarding the number of fur-rabbit breeders in Britain, but it must be very large, since the British Fur Board (fur boards are co-operative associations formed, under Government auspices, to tan, sort, and sell the pelts sent in by small scale owners only) had over 2,500 members last year, and similar boards have been established in Scotland and Ireland, but by no means all small owners join them, many preferring to dispose of their pelts to furriers direct. Many of the large rabbitries will purchase pelts, and some of them have instituted what is known as the "buy back" system, under which any approved person can purchase does in kindle or breeding trios at special rates, the vendor agreeing to buy all progeny at a fixed price when they reach the pelting age. With those whose employment takes them away from home for the greater part of the day, the fur rabbit is more popular than the Angora, since it requires much less attention, in fact two good meals a day and a clean, airy hutch are all that it needs. Australia, which actually imports some £400,000 worth of furs, should prove an excellent market for New Zealand, and, no doubt, the fur breeders and furriers in the Dominion pray that the Commonwealth may long retain the proud position of the only country in the world to prohibit the introduction of fur and wool-bearing rabbits.

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of 613-619 Wellington Street, Perth, have supplied us with the following information regarding chaff available at the metropolitan chaff and grain auction sales held in Perth for the period March to May, 1929 (inclusive). In all cases the prices quoted are for f.a.q. to prime wheaten chaff, packed in new bags:—

March—Quantity, 1,050 tons; maximum, £6 10s. per ton; minimum, £6 5s. per ton.

April—Quantity, 1,690 tons; Maximum, £6 5s. per ton; minimum, £5 10s. per ton.

May—Quantity, 1,200 tons; maximum, £6 10s. per ton; minimum, £5 12s. 6d. per ton.

During March supplies available were not heavy, and the market remained steady, f.a.q. to prime realising £6 10s. per ton, but in April heavy yardings were arriving and values eased to £5 12s. 6d. per ton, and in several instances as low as £5 10s. In May, owing to the extremely wet weather experienced, yardings were lighter and the market firmed, f.a.q. to prime selling at from £6 5s. to £6 10s. However, during the past week or two, prices have again fallen, the following being closing quotations:—

F.a.q. to Prime—£5 7s. 6d. to £5 10s. per ton.

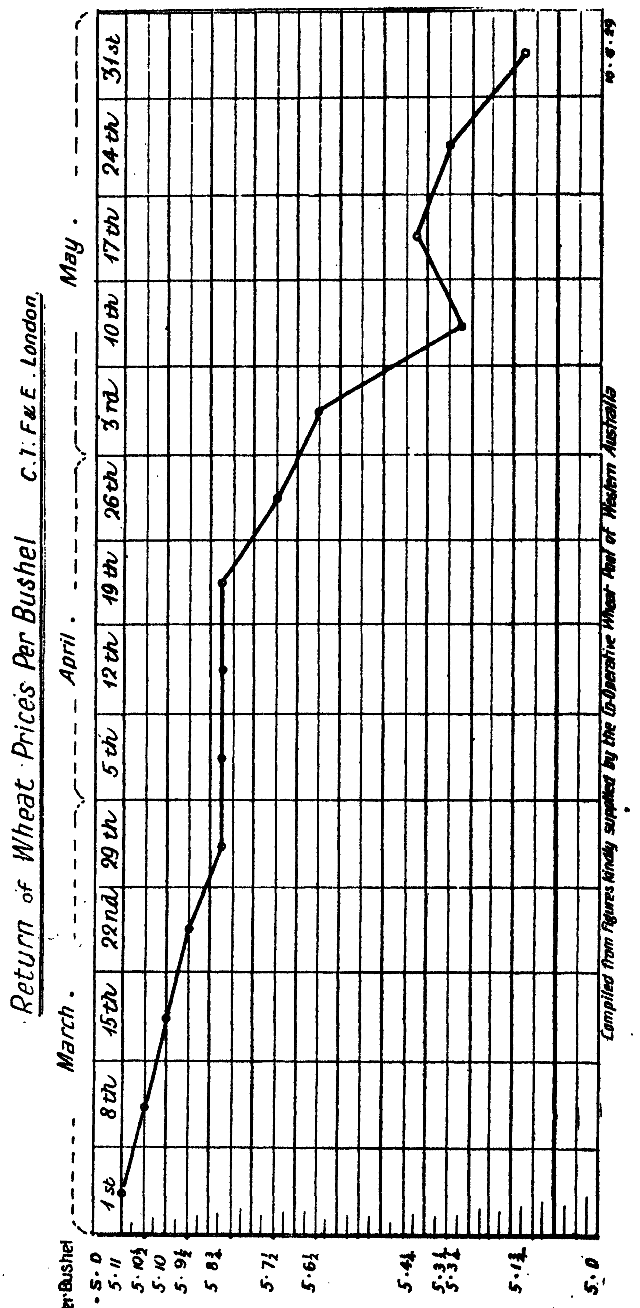
F.a.q.—£5 to £5 2s. 6d. per ton.

Mediums—£4 12s. 6d. to £4 15s. per ton.

Oaten Chaff.—During March and early April very few consignments of prime quality were coming to hand, and this was in request at from £6 to £6 5s. per ton. However, at the latter end of April, under weight of supplies arriving, the market eased, prime samples selling at from £5 10s. to £5 12s. 6d.; f.a.q., £5 to £5 5s.; but in May, in sympathy with wheaten, the market firmed a little, f.a.q. realising up to £5 15s., mediums £4 15s. to £5., there being practically no consignments of prime quality available.

Oats.—Right throughout the period under review good heavy feed samples have been firm at from 3s. 1d. to 3s. 3d. per bushel. Prices now, however, are not quite so satisfactory, good heavy feeds realising from 2s. 9½d. to 2s. 10s., light feeds 2s. 7d. to 2s. 9d., and it is not likely that any improvement in this market will be forthcoming for some considerable time.

Wheat.—In sympathy with the overseas market, local values have eased considerably, f.a.q. selling during the last week or so at from 4s. 5d. to 4s. 6d. per bushel; other qualities at lower prices according to sample.


Return of Wheat Prices Per Bushel C.I.F.&E. London.
March.
April.
May.
1st
8th
15th
22nd
29th
5th
12th
19th
26th
3rd
10th
17th
24th
31st
Per Bushel
£ s. d.
5.11
5.10½
5.10
5.9½
5.8¾
5.7½
5.6½
5.4¼
5.3½
5.3¼
5.1¾
5.0
Compiled from figures kindly supplied by the Co-Operative Wheat Pool of Western Australia

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK YARDED AT METROPOLITAN FAT STOCK MARKETS FOR MARCH, APRIL, AND MAY, 1929.

—	March, 1929.				April, 1929.				May, 1929.				
	6.	13.	20.	27.	3.	10.	17.	24.	1.	8.	15.	22.	29.
Sheep and Lambs	12,674	10,614	11,687	10,740	10,812	9,904	11,456	13,265	12,323	8,779	9,321	9,660	9,745
Cattle ...	579	556	474	180	298	468	297	517	566	643	407	823	690
Pigs ...	769	430	503	526	640	639	665	535	593	531	590	437	438

COMPARATIVE VALUES PER LB. OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS DURING MARCH, APRIL, AND MAY, 1929.

—	March, 1929.				April, 1929.				May, 1929.				
	6.	13.	20.	27.	3.	10.	17.	24.	1.	8.	15.	22.	29.
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
Mutton ...	7¾	7¾	8	8½	8¾	9¼	9¾	8½	8¼	10	10¼	10½	[illegible]
Beef ...	9½	9½	9½	9½	10	9½	8¾	7½	8¼	8¼	8¾	8½	8½
Pork ...	11½	12	12	12¼	12½	13	13	13	13	13	13	13	13½
Bacon ...	10	10¼	10¼	10½	10½	10½	10½	10¾	10½	10½	10½	10½	10¾

METEOROLOGICAL INFORMATION.

MARCH, 1929.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	89·8	102·0	60·6	43·0	0·20	0·69
Geraldton	85·0	94·0	64·0	54·0	0·01	·47
Walebing	83·2	100·2	57·5	47·0	0·81	·76
Perth	80·9	93·2	59·7	50·4	0·09	·80
Kalamunda	79·7	93·0	56·6	46·0	0·18	·90
Bunbury	78·5	88·2	52·4	44·2	0·44	1·02
Bridgetown	81·5	93·2	48·2	34·0	1·66	1·04
Albany	68·8	80·6	57·4	52·0	0·83	1·56
Merredin State Farm	80·7	98·2	57·2	45·1	0·77	1·01
Northam	83·4	100·0	57·5	47·8	0·70	·73
York	82·5	99·0	55·2	45·0	0·50	·65
Narrogin State Farm	78·8	95·0	51·2	41·0	0·10	·79
Katanning	77·6	93·7	52·6	41·3	0·11	·98
Cape Leeuwin ...	70·7	82·0	59·3	53·2	0·83	1·26

APRIL, 1929.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	82·7	95·8	54·8	46·7	0·10	0·45
Geraldton	78·6	98·0	58·3	50·2	0·06	·84
Walebing	78·9	94·0	50·5	42·4	0·17	·79
Perth	73·6	92·1	54·9	45·0	1·20	1·64
Kalamunda	72·6	88·5	53·3	39·0	0·79	1·93
Bunbury	71·1	83·8	48·6	37·2	1·02	1·74
Bridgetown	74·4	91·8	45·7	35·0	2·73	1·70
Albany	68·2	83·0	53·5	46·0	3·15	2·74
Merredin State Farm	77·0	94·0	49·9	39·6	0·00	·76
Northam	77·7	92·3	49·9	40·2	·13	·81
York	77·2	90·2	48·6	38·0	0·08	·83
Narrogin State Farm	71·9	85·2	46·5	36·0	0·46	1·18
Katanning	71·2	85·4	47·0	35·3	0·46	1·19
Cape Leeuwin ...	67·7	88·0	58·3	50·0	3·29	2·15

MAY, 1929.

Stations.	Temperature. Maximum. Mean.	Temperature. Maximum. Highest.	Temperature. Minimum. Mean.	Temperature. Minimum. Lowest.	Rainfall. For Month.	Rainfall. Average.
					inches.	inches.
Chapman State Farm	71·3	84·3	53·0	46·9	4·24	2·31
Geraldton	72·2	85·2	59·4	52·0	4·29	2·79
Walebing	66·1	77·9	48·8	41·1	5·31	2·50
Perth	66·5	77·2	53·2	45·6	11·50	4·97
Kalamunda	64·5	78·0	50·4	44·0	12·28	5·91
Bunbury	66·3	77·5	50·8	39·2	5·33	5·30
Bridgetown	64·5	76·2	43·9	32·8	8·41	4·54
Albany	63·9	73·6	49·4	39·0	4·12	5·04
Merredin State Farm	63·2	75·4	49·2	37·2	3·57	1·22
Northam	65·9	77·8	49·1	39·2	3·68	2·19
York	65·5	75·2	48·0	36·0	3·05	2·30
Narrogin State Farm	61·6	71·2	44·7	36·0	4·71	2·76
Katanning	62·1	72·0	45·8	35·0	4·82	2·28
Cape Leeuwin ...	64·6	72·5	54·1	42·0	10·59	5·63

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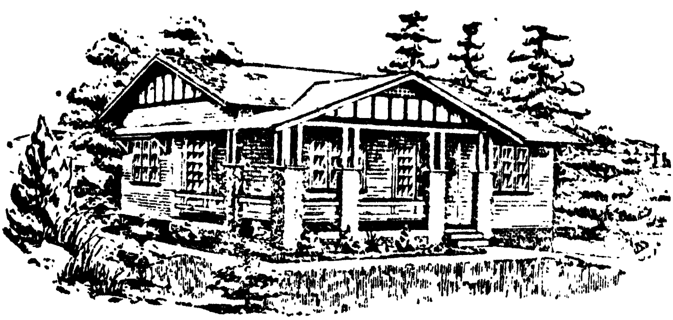

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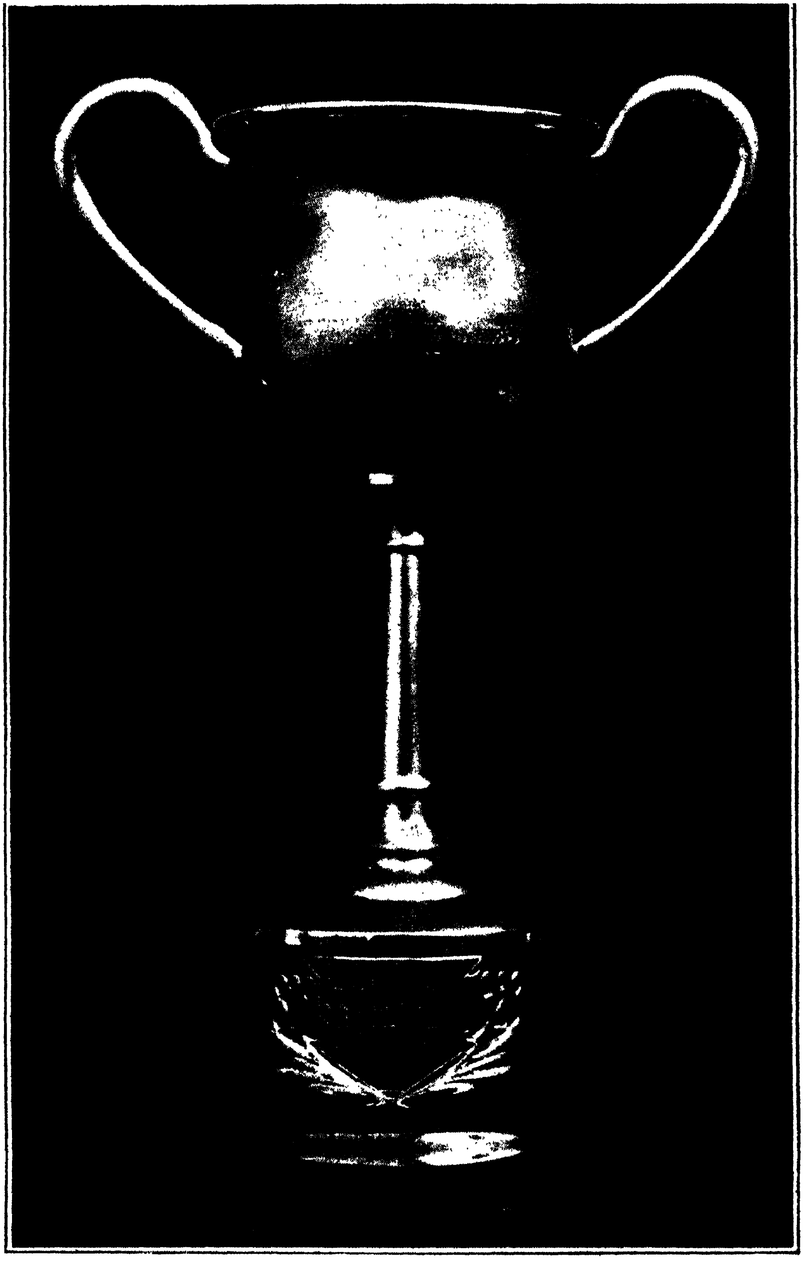

The Bateman Centenary Wheatgrowers' Cup.

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THE BATEMAN CENTENARY WHEATGROWERS' CUP.

By the Editor.

It was in April this year that the family of the late J. W. Bateman, who are the personnel of the well-known firm of J. & W. Bateman, Ltd., conceived the idea of associating the name of their father with the Centenary Year celebrations.

It was a conception ambitious, yet not pretentious, for the founder of their business made his advent in Western Australia at a time almost synchronising with the birth of the then Colony. What then could be more appropriate than to link up with the genesis and progress of the State the gradual growth, the contraction and expansion of business that followed the ebb and flow in the tide of Westralia's fortune, with the name of him who had taken risk for risk; who had looked clear sighted into the future, and banked upon the promised land of his adoption to take him to that altitude of achievement and prosperity that both the firm and the State now happily enjoy.

But every end requires a means thereto. It is easy work to think upon the past, to compare a correspondence of incidents and trace the lines of circumstance as they converge to a given point—Success.

Yet to intertwine the paths of progress without fracturing the concept of relationship between individual and communal effort requires more care ful thought. The most prominent feature of our development at the present day is found in our extensive wheat areas and improved agriculture. It is the aim of our farmers to celebrate the Centenary year with a record

harvest, and so it occurred to the descendants of the Bateman family that they might participate in the celebrations and at the same time commemorate their ancestor in an endeavour to stimulate this desideratum—a record harvest.

Our Director of Agriculture, Mr. Geo. L. Sutton, was consulted, and the advice of the Superintendent of Wheat Farms, Mr. I. Thomas, was sought, as to the methods to be employed. The donation of a Cup was the best suggestion. But what sort of a competition should it involve? There had already been competitions devised to encourage better farming and increased yields and these had been of undoubted benefit to the State; but they depended on actual yields over the whole farm, or, on district team work. The donors desired to break away from the beaten track and seek a fresh avenue for their enterprise. After suggestions and consultations it was decided to present a gold Cup valued at £50 the conditions of competition being entirely novel to the State, and, as far as is known, to any part of the Commonwealth or the world. These conditions have been made widely known already. It will be a Centenary Cup to become the sole property of the successful competitor. It can be won but once. Whether another Centenary Cup will eventuate one hundred years hence does not concern the present generation.

The Bateman Centenary Wheatgrowers' Cup is unique in that respect and in keeping with this fact the award will be made, not on the yield per acre, which gives to the farmer in the better rain belt a decided advantage, but it will be on the yield per acre per inch of rainfall during the conventional growing period, from May 1st to October 31st inclusive; and each competitor must harvest not less than 200 acres for grain. The average yield will be ascertained from the total area harvested for grain. The Judge will visit each competitor's farm and measure up the stripping area also ascertaining the quantity of wheat on hand. On or before the 31st January the farmer will be required to furnish a sworn declaration as to the quantity of wheat sold from the competing holding. This will have to be supported by agent's dockets and the declaration will include the amount retained for seed and other purposes. From the information thus obtained the average yield per acre will be computed. Arrangements have been made with the Commonwealth Meteorological Bureau to supply, as nearly as possible, the rainfall around the competitors farms during the period already mentioned.

The salient feature of the competition is to ensure, as far as humanly possible, that the award shall be for merit. Those who decide to enter the list of competitors—and it may be mentioned that there is no charge of any kind for entry—are assured that the result of their efforts cannot be easily affected in an adverse way. Entrants from the outer fringes of the wheat belt have equal opportunities with those in the more favoured zone, a factor which should inspire courage and interest.

The donors of the Centenary Cup are to be congratulated on their patriotic efforts as are also those who conceived the principles of the competition. The Cup itself, which is here illustrated, is seen to be a beautiful specimen of the goldsmith's art designed with a simplicity that provides much of its charm. It is fashioned from gold taken from our own mines, for which the State is so famous, and stands upon a plinth made from our own West Australian jam wood, typical of our wheat areas. On the face of the burnished bowl is inscribed in conventional text—

Presented by the Family of the Late J. W. Bateman

To the grower who, with a minimum of 200 acres obtains the best average acre yield of wheat per inch of rain which fell during the growing period, May 1st to October 31st in the season 1929.

Won by

The plinth bears a gold shield on which appears the following:—

Number of acres cropped.
Average yield per acre.
Average yield per inch of rain.
Number of Competitors.

Manufactured from the product of an industry which gave that stimulus to the State that caused its leap from comparative obscurity into brilliance: that prominence, popularity and prosperity that fostered the agricultural industry and discovered our wonderful grain-growing potentialities, it typifies how at this, the end of our first century, these have been realised.

Every farmer should be attracted to this competition, for he who by his industry and perseverance succeeds in winning this unique Trophy will have something to hand as an heirloom to his proud descendants, for all time—The Bateman Centenary Wheatgrowers' Cup.

FRUIT PRODUCTION AND EXPORT.

Geo. W. Wickens.
Superintendent of Horticulture.

The Fruit Industry in Western Australia has celebrated the State's Centenary year by producing a record crop, the major portion of which was sold at prices which meant a distinctly profitable return to growers. Not all kinds of fruit, nor all growers have been equally fortunate, for while stone fruit and grape crops were up to the average, the pear crop was a little under, and the citrus crop considerably under the average; the apple crop, however, was the best the State has known, and as 54 per cent. of the area under orchards (apart from vineyards) is comprised of apples, the total production of fruit in 1929 easily constitutes a record. The final figures regarding production will not be available until September next, but the quantity exported shows that the original estimate made in December last of 1,100,000 cases of apples was a conservative one, and will be exceeded. The previous heaviest apple crop occurred in 1927, when 901,464 cases were harvested, and in that year also, the largest number of cases up to that time were exported: the overseas shipments totalling 494,641 cases and Eastern States consignments 33,560 cases. To the 30th June this year the overseas shipments of apples amounted to 654,982 cases and Eastern States consignments 166,032 cases.

The total quantity of all kinds of fruit shipped from Western Australia to overseas markets for the year ended 30th June, 1929, amounted to 737,676 cases: of these 732,219½ cases were exported during the period from 1st January to 30th June, 1929, the remainder—5,456½ cases—comprised portion of last year's production and were exported during the six months ended 31st December, 1928.

The Continent of Europe received 445,253¼ cases, or 60 per cent. of the total quantity: Great Britain 209,875¾ cases and the balance—82,547 cases—were sent to Singapore, Colombo, Sourabaya, Batavia, Port Said, Durban and Mauritius.

During the season from 20th February to 14th May, 1929, twenty-seven boats loaded fruit from Western Australia for Great Britain and Europe: 410,813 cases being shipped at Fremantle and 244,316 cases at Albany.

Shipments during the various months were divided up as follows:—

	Great Britain cases.	Continent of Europe. cases.
February	2,987	
March	83,705½	298,312¼
April	95,078	131,489
May	28,105¼	15,452
	209,875¾	445,253¼

Full particulars showing quantities and destinations are as follow:—

EXPORT OF FRESH FRUIT FROM WESTERN AUSTRALIA FOR YEAR ENDING 30TH JUNE, 1929.

Destination.	Apples.	Pears.	Grapes.	Peaches.	Plums.	Nectarines.	Tomatoes.	Rock Melons.	Passion Fruit.	Quinces.	Persimmons.	Oranges.	Lemons.	Totals.
	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.	cases.
Colombo	9,706	10	16,761	2	39	6	...	...	...	...	...	490	...	27,014
Singapore	17,664	308	9,320	55½	161	3	12	...	...	...	...	1,601	76	29,200½
Sourabaya	10,332	151	3,211	24	92	...	...	5	...	...	...	162	10	13,987
Batavia	3,086	228	1,769	...	27	...	...	...	...	...	...	577	55	5,742
Port Said	5,119	102½	274	11	7	...	...	...	...	...	...	...	...	5,513½
London	130,051	19,964¾	15,883	6	15	...	...	...	4	31	3	...	...	165,957¾
Hamburg	344,718	8,588	123	...	...	...	...	...	...	37	...	...	...	353,466
Rotterdam ...	30,718	...	...	...	...	...	...	...	...	...	...	...	...	30,718
Gothenburg ...	9,797	...	...	...	...	...	...	...	...	...	...	...	...	9,797
Dunkirk	327	...	...	...	...	...	...	...	...	...	...	...	...	327
Stockholm	49,354	836¼	145	...	...	...	...	...	...	...	...	...	...	50,335¼
Mauritius	150	...	40	...	...	...	...	...	...	...	...	...	...	190
Antwerp	610	...	...	...	...	...	...	...	...	...	...	...	...	610
Liverpool	14,852	178½	500	...	...	...	...	...	...	25	...	...	...	15,555½
Glasgow	10,485	107½	366	...	...	...	...	...	...	...	...	...	...	10,958½
Hull	17,113	...	291	...	...	...	...	...	...	...	...	...	...	17,404
Durban	900	...	...	...	...	...	...	...	...	...	...	...	...	900
	654,982	30,474½	48,683	98½	341	9	12	5	4	93	3	2,830	141	737,676

PIGS AND PIG-RAISING.

(Continued.)

P. G. HAMPSHIRE,
Superintendent of Dairying.

YORKSHIRE.

Origin Yorkshire, England. Bred from the old English hog, a large white animal. The small Yorkshire derives its refinement to Chinese crosses, and the Middle Yorkshire to a cross between the two. The Middle Yorkshire was classed separately in 1852. Improvement commenced about 150 years ago. Yorkshire blood widely diffused throughout the world in all white breeds.

A Middle Yorkshire Sow.

Characteristics—

Relative size.—The Large Yorkshire is probably the largest of the breeds, and one of the heaviest, if not the heaviest. Middle Yorkshire and Small describe their size.

Adaptability.—Excellent for bacon and pork, especially where large sides are required. Good doers, excellent for crossing upon weaker types. Inclined to sun scald; prefer cool climate owing to this liability.

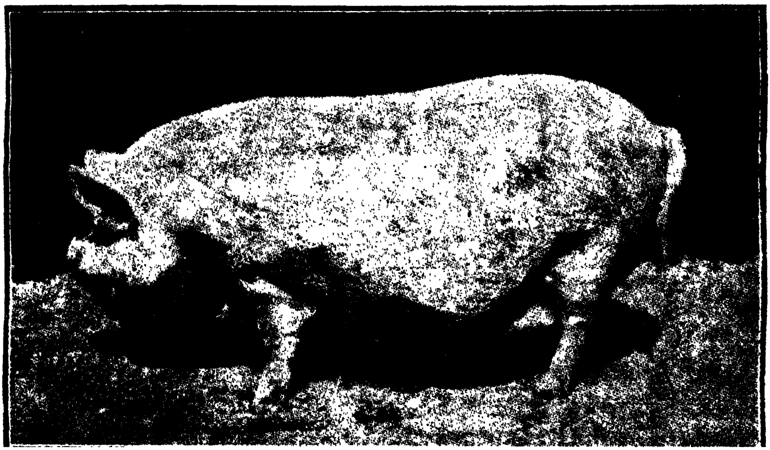
Maturing qualities.—Large Yorkshire, not so quick as smaller varieties. Requires from six to nine months for market bacon.

Grazing and feeding qualities.—Graze and forage well in cool climate. Gentle disposition. Must be plentifully supplied with food to make economical flesh. Look wretched out of condition. Compare unfavourably with black breeds. Not as hardy as Berkshire. Good growers, sty fed.

Quality of meat.—Good, especially for large "side" markets. Fat and lean, fairly well balanced. The Small Yorkshire excels as a porker.

Value for crossing or grading.—For small fine boned sows good, will increase size, improve vigour, improve quality of meat, and increase prolificacy.

Breeding qualities.—Excellent, regular large litters and good mothers. Good tempered, gentle and tractable.



A Small Yorkshire Sow.

Principal points—

Head.—Long, lightish, wide between eyes.

Ears.—Long, fine, inclined forward.

Jowl.—Light.

Neck.—Long, muscular.

Shoulders.—Sloping, no coarseness.

Back.—Long, wide, straight or slightly arched.

Barrel.—Deep, full rounded, well sprung ribs, flanks well let down, long, wide, square.

Hams.—Broad, full meat to hocks.

Legs.—Straight and strong.

Feet.—Firm.

Skin.—Cream colour, freedom from wrinkles or dark spots.

Hair.—Long, straight, fine.

Colour.—Pure white.

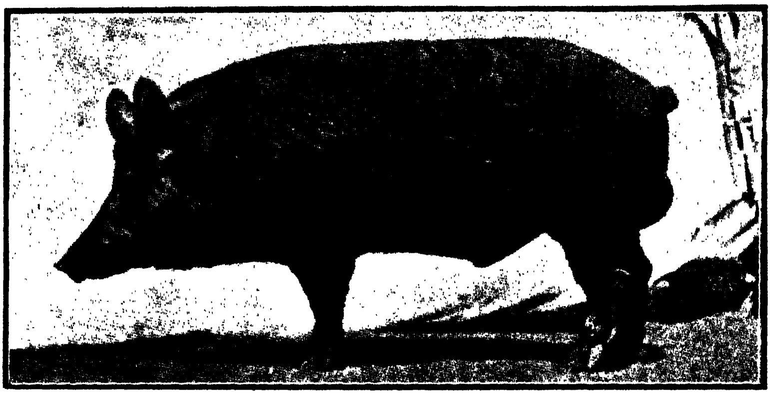
Objections.—Ears, coarse, flopping; shoulders, coarse; weak back; unshapely hams; weak loins; crooked legs; weak feet; coarse curly hair; action, sluggish.

Disqualifications.—Black or red hair or spots on skin.

Middle Yorkshire differs from Large Yorkshire in reduction in size, weight, length, and has a distinctly short snub nose and short neck.

TAMWORTH.

Derive name from Tamworth, Staffordshire, England, where they have been bred for a long period. They are probably the oldest and purest of all breeds in England. This (as in all breeds of pure animals) accounts for the wonderful, marked prepotency of the Tamworth. At the beginning of the 18th century they were noted for large proportion of lean meat they produced. Have been greatly improved by selection, but it is generally conceded that no mixture of the breeds has been introduced in improvement. As early as 1847 they were given premier honours in competition with other large breeds at Royal Agricultural Show, England. Following this they went out of favour, but regained popularity from 1880 onwards.



A Tamworth Boar.

Characteristics—

Relative size.—At least second to Large Yorkshire, and in some cases even larger. Hardihood and vigour in keeping with size.

Adaptability.—Unexcelled.

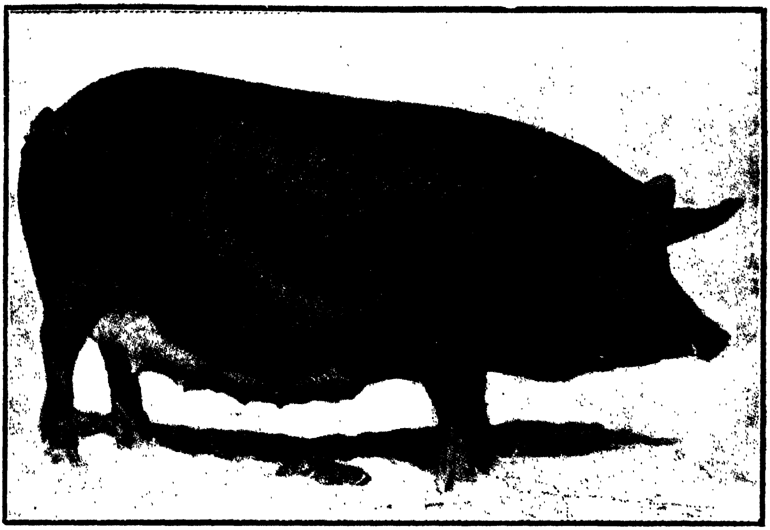
Maturing qualities.—Comparatively slow, not equal to the smaller or refined breeds.

Grazing and feeding qualities.—Excellent grazers, wonderful foragers. Exceptionally hardy; will stand forced feeding. Very suitable open conditions. Powerful digestion, but must not check growth.

Quality of meat.—Excellent on account of leanness. Bone coarse. Exceptionally good to cross with to improve meat for bacon. Less waste in cooking, good flavour.

Value for crossing or "grading up."—Excellent when crossed with small compact over refined grade sow. Impart size, development, vigour, and prolificacy, more and better meat (very big factor). Good growers. Good mothers. Excellent travellers to market.

Breeding qualities.—Unexcelled for prolificacy and hardiness, freedom of parturition troubles. Ideal mothers, rarely overlies her young, great defenders, good sucklers.



A Tamworth Sow.

Principal points—

Head.—Long, lean, light, tapering to snout.

Ears.—Moderate size, fairly erect, pointing forward.

Jowl.—Light.

Neck.—Long, rather deep than wide, tapering.

Shoulders.—Sloping, good thickness through heart.

Back.—Moderately wide, long, slightly arched.

Barrel.—Long in coupling, deep ribs, well sprung.

Rump.—Deep, fairly full, rounded.

Ham.—Large, gradually rounded off rather than square.

Legs.—Moderately long, strong, firmly placed under body.

Skin.—Smooth, plentifully covered with hair.

Hair.—Freedom from coarseness.

Colour.—Bright golden red, no black.

Objections.—Shoulders coarse, open at top. Ribs flat, weak coupling, shallow body.

Disqualifications.—Black or white hairs. Black skin.

(*To be continued.*)

"THE JOURNAL OF AGRICULTURE"

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CHAPMAN EXPERIMENT FARM.

BUNT RESISTANCE TEST—1928.

D. R. BATEMAN,
Seedsman.

This experiment is planted to test the liability or resistance to Bunt of all new fixed cross-breds from the Merredin and Chapman Experiment Farms, and also any varieties of promise from other sources.

NEW CROSS-BREDS ARRANGED ACCORDING TO INFECTION AS COMPARED WITH BOORAN 100 PER CENT.

Reg. No. P.	Variety of Cross-bred. Resistant.	1928.	1927.
C 74	D.A.C. 4179 x Florence ...	...	...
C 80	Dindiloa x Nabawa	...	...
C 86	Florence x Velvet Don ...	...	...
M 28	Dindiloa x Nabawa	...	...
M 29	Dindiloa x Nabawa	...	...
M 30	Dindiloa x Nabawa	...	...

Reg. No. P.	Variety. Fairly Resistant. 1-20.	1928.	1927.
C 76	Minister x Toby's Tusk ...	...	7
C 81	Florence x Nabawa	...	5
C 77	Florence x Carrabin	1	2
M 32	Florence x Fortune	1	9
C 73	D.A.C. 4179 x Florence ...	3	3
M 24	Florence x Carrabin	3	11
M 33	Florence x Nabawa	3	11
M 27	Nabawa x Carrabin	7	2
M 25	Nabawa x Carrabin	9	16
M 26	Nabawa x Carrabin	11	20
C 82	D.A.C. 4179 x Nabawa ...	16	...

Reg. No. P.	Variety. Susceptible. 21-50.	1928.	1927.
C 65	Huguenot x India 5	...	29
C 85	D.A.C. 4179 x Nabawa ...	9	39
C 69	Warren x Bayah	15	42
M 23	Federation x Carrabin	23	24
C 70	Federation x Bunyip	23	26
C 88	D.A.C. 4179 x Nabawa ...	28	32
C 66	Hard Federation x Gluyas Early	36	...
M 31	Gluyas Early x Nabawa ...	28	47

Reg. No. P.	Variety. Very Susceptible. 51—100 or over.	1928.	1927.
C 84	D.A.C. 4179 x Nabawa ...	17	85
C 68	Currawa x Gluyas Early ...	51	69
C 67	Toby's Tusk x Nabawa ...	83	92
C 78	Clubhead x Vindesso	113	110

VARIETIES ARRANGED IN ORDER, AS COMPARED WITH BOORAN 100 PER CENT.

Reg. No. P.	Variety. 0 per cent.	1928.	1927.	Reg. No. P.	Variety. 1—20 per cent.	1928.	1927.
1460	Piastre	...	...	1705	Nabob	4	5
1758	Minflor	...	...	1713	Churkha	6	...
				1451	Bunge No. 1 x Emmer ...	9	13
				1801	Yetna	10	3
				1785	Aussie	11	...
				1756	Wardtir	17	12

Reg. No. P.	Variety. 21—50 per cent.	1928.	1927.	Reg. No. P.	Variety. 51—100 per cent or over.	1928.	1927.
1714	Gallipoli	9	23	1610	Akakomuga	25	67
1786	Riverina	12	50	1627	Waratah	25	84
1746	Minyip	13	25	1752	Currawa x Minister	29	52
1697	Ranee	14	27	1736	Boonoo	29	56
1710	Rajah	18	50	1708	Mahratta	29	70
1706	Kritnia	18	25	1777	Union	33	87
1608	Golden King	21	...	1748	Currawa x Minister	18	60
1727	Boolaroo	25	35	1601	Crossbred 12	36	87
1696	Confederation	28	35	1775	Bredbo	36	90
1614	Bena	28	40	1774	Duri	38	90
1709	Marmora	30	25	1536	Barwang	40	62
1715	Babakin	34	27	1750	Inderet	41	80
1779	Bluestem (Nabawa)	35	19	1770	Millard	42	121
1695	Sepoy	37	29	1744	Dookie Delta	51	83
1700	Alliance	38	45	1513	Onas	53	77
1188	Cowra, 26...	44	42	1754	Gluclub	53	86
1741	Omrah	49	23	1602	Crossbred 78a	54	68
1182	Wandilla	50	40	1512	Felix	56	27
				1729	Canimbla	63	92
				1712	Sterling	64	95
				1721	Lilydale	68	...
				1609	Nugget	69	56
				1702	Empire	72	87
				1711	Viceroy	75	70
				1755	Federation x 1878	75	118
				1739	Exquisite	78	113
				1463	Patriot	78	127
				1726	Bobin	85	100
				1701	Parsee	85	116
				1704	Sovereign	86	95
				1773	Early Bird	87	10
				1698	Capitol	88	93
				1776	Dollar	88	77
				1749	Federation x Nabawa	95	95
				1449	Bunge No. 1 x I.P. 4	99	87
				1728	Cadia	103	88
				1703	Mogul	103	91
				1792	Joffre	116	...
				1382	Triumph	143	106

COMMUNITY SPRAYING AT GOSNELLS.

CHAS. SIMMONS,
Orchard Inspector.

At the Annual Meeting of the Gosnells Fruit Growers' Association, at which there were present the Director of Agriculture (Mr. Geo. L. Sutton), the Superintendent of Horticulture (Mr. G. W. Wickens) and the Economic Entomologist (Mr. L. J. Newman), several speakers spoke enthusiastically of the co-operative baiting which had been carried out in the district to combat Fruit-fly.

The Director of Agriculture was so impressed with the success of the scheme that he requested me, as Orchard Inspector for the district, to prepare, for publication in the *Journal of Agriculture*, the following article, which contains full details of the scheme.

The Gosnells District Growers' Association provide its members with a service of community spraying for the control of Fruit Fly throughout the summer season.

A committee chosen by the members of the association meet and appoint the men who do the work of spraying. The man provides the vehicle and the knapsack spraying apparatus. The association provides the bait. Green's Fruit Fly Bait is the lure used. It is a local product, and has been found to be effective.

In the 1928-1929 season two men were engaged at 18s. per day, who worked four to five and a-half days per week each from 12th November to 7th May, 1929.

The district covered by the spraying comprised Maddington, Gosnells, and Kelmscott, and over 90 per cent. of the growers within that area came into the scheme.

This area covered a piece of country 10 miles long and two to three miles wide, mainly running along the banks of the Canning River. It was divided, each man taking half, and arranging his round so as to be at each orchard every seventh day. The sequence of visits was adhered to, except when interrupted by violently windy mornings or by wet days.

A sufficient quantity of bait for the day's work was carried in the vehicle, and mixed as required.

The men went into the orchards and sprayed the trees carrying fruit sufficiently developed for the Fruit Fly to use as a depository for eggs, and in addition a proportion of all the lemon and orange trees were sprayed; the idea being to bait the likely feeding places of the fly.

A count was kept of the trees sprayed each time in every orchard, and a record of the time taken in spraying.

On completion of each visit the orchardist signed a book made out in the following manner (copy of actual record):—

ROUND No. 5.

Date.	Name and Address.	Trees Baited.	Orchardists Signature.	Time.
13-12-28	Godber, Gosnells Road ...	18	G. Godber	8·50
13-12-28	Taylor, Gosnells Road ...	32	J. Taylor	9·15
13-12-28	Smith, Gosnells Road ...	13	B. Smith	9·30
13-12-28	Lauterbach, Fremantle Road ...	72	E. Lauterbach ...	10·15
13-12-28	Hosken, Fremantle Road ...	99	T. Hosken ...	11·10
13-12-28	Chapman, Fremantle Road ...	10	Out	11·30
13-12-28	Armstrong, Fremantle Road ...	33	S. Armstrong ...	11·55
13-12-28	Wilkinson, Homestead Road ...	27	J. Wilkinson ...	1·45
13-12-28	Pritchard, Homestead Road ...	43	A. Pritchard ...	2·40
13-12-28	Investments, Ltd., Homstead Road	57	R. Lohrman ...	3·55
13-12-28	Lissiman, Homestead Road ...	300	N. Lissiman ...	5·20
13-12-28	Dagleish, Homestead Road ...	9	A. Dagleish ...	5·35
13-12-28	Albutt, Homestead Road ...	9	Out	5·45
	Trees	722	Orchards ...	13

This day book remains with the sprayer, and serves as a record from which the man renders his account. It is a necessary record to meet any query regarding the date of a sprayer's visit, and shows to the committee the number of trees sprayed.

At each fortnightly meeting of the committee the men employed present an account of the rounds completed, and these reports remain in possession of the secretary. Herewith is a copy of such a report:—

1928–9.

REPORT ON 5TH ROUND—FRUIT FLY BAITING.

Date.	No. of Trees Baited	No of Orchards	Remarks
11-12-28	609	14	
12-12-28	741	17	
13-12-28	722	13	
14-12-28	446	12	Saturday, 15th, East wind; 14th showers till 2 p.m.
17-12-28	394	3	
18-12-28	369	11	
Totals	3,281	70	

Time: 5 days

Additional members: Mr. Jones, Mills Road; Mr. Hayes, Wheatley Road.

Signed: W. H. Gauthern.

On the adoption of reports as shown, the Secretary then pays the wages accounts.

By the end of the season the records of the rounds of sprayings for the two men were:—

Rounds.	Number of Trees Baited.	Number of Orchards.	Days Labour.
	Trees.	Orchards.	Days.
1st Round. 17-11-28	7,441	107	11
2nd Round. 24-11-28	7,637	124	10
3rd Round. 1-12-28	7,496	131	10½
4th Round. 10-12-28	8,804	144	10½
5th Round. 18-12-28	8,415	147	10½
6th Round. 28-12-28	7,799	146	11
7th Round. 9-1-29	6,375	120	10½
8th Round. 18-1-29	6,397	117	9
9th Round. 26-1-29	6,457	111	8½
10th Round. 6-2-29	6,282	107	8½
11th Round. 19-2-29	6,350	109	8½
12th Round. 2-3-29	7,254	120	12
13th Round. 12-3-29	6,489	115	10
14th Round. 20-3-29	6,732	114	9½
15th Round. 30-3-29	6,392	113	9½
16th Round. 12-4-29	6,595	112	9½
17th Round. 22-4-29	6,331	107	9½
18th Round. 1-5-29	6,662	94	9
19th Round. 6-5-29	1,010	26	2½
19 Rounds.	126,918	2,164	180

Approximately 12 orchards per day were sprayed by each man. Between 57 and 58 trees was the average number sprayed in each orchard per visit. An average of 705 trees were sprayed by each man per day. Approximate cost (labour only) per tree, three-tenths of a penny.

From 12th November, 1928, to 5th May, 1929, 126,918 trees were sprayed, at a cost of 180 days (labour) at 18s. per day, £162; workers' compensation insurance, £1 8s. 9d.; 84 gallons Fruit Fly lure, £32 1s. 6d.; total £201 10s. 3d., an average cost per tree of two-fifths of a penny.

The 1928-1929 balance sheet of the Gosnells' District Association covers a period of 15 months, the departure from the usual 12 months being caused by the alteration of the date of the annual general meeting to a more convenient time.

During that period 137,843 trees were baited, at a cost of £229 10s., or approximately three-eighths of a penny per tree.

In order to collect the money to cover the cost of spraying, the association instituted two charges, one of 2s. 6d. membership fee for the payment of hall rent, printing, stationery, and postage; and another to cover the cost of wages, insurance, and bait. This was fixed on a graduated scale based on the number of trees each member owned.

These charges, adopted for the ensuing year, are membership fee 2s. 6d., and for spraying trees for the summer season, up to and including 12 trees, 7s. 6d.; 25 trees, 12s. 6d.; 50 trees, £1; 100 trees, £1 5s.; 350 trees, £3 7s. 6d.; over 350 trees, 2s. for each additional 100.

Considering the cost of spraying per tree as ½d., a Dunhelm peach tree can be sprayed from 11th November to 30th December for threepence. A pear tree sprayed from 4th January to 30th April for fourpence. A Late Valencia orange tree from 11th November to 11th February for fourpence.

The amount of bait used each time of spraying per tree varies from ½ to 1 gill, according to the size of the trees. Fig trees, of course, take more.

Every stone fruit, pear, apple, quince, fig, persimmon and guava tree is sprayed, but it has been found effective to spray only every third or fourth row of orange and lemon trees, except toward the end of the season for late Valencia oranges, when every tree is sprayed.

When, four years ago, the Gosnells District Growers' Association started this scheme, it was hoped that the continued and regular use of Fruit Fly bait would stop the great losses then being suffered by its members, and in this the association has been entirely successful.

No member of the association has had a case of fruit condemned in the markets last season, nor has the inspector had occasion to order fruit to be stripped off the trees.

The writer took over a neglected orchard in January this year, containing peach, plum, pear and fig trees. Ten shillings covered the cost of spraying from January to May, and the fruit came through the season without any loss by Fruit Fly; while three miles away, at Armadale, outside the sprayed area practically every late peach, pear, and fig had to be stripped off and destroyed, because of Fruit Fly infection.

The effect of such efforts as this of the Gosnells District Growers' Association is to stimulate the growers in the habit of picking up their fallen fruit. It enhances the market value of the fruit. It increases the orchard values on the properties, and while encouraging the growers to take care of the orchards they already have, they also feel safe in planting new areas, confident they can prevent losses from Fruit Fly.

A PINK FLOWERED SUBTERRANEAN CLOVER.

A. B. Adams, B.Sc. (Agr.)

This season a new type of Early Subterranean Clover has been noticed in the First Early Subterranean Clover pasture at Muresk Agricultural College.

There are a number of plants of the new type growing close together, and this shows that at least one plant of the same type was growing there last year.

All the plants in this particular cluster are similar to each other in appearance which would appear to indicate that they are the produce of a sport or variation rather than the result of a natural cross between two varieties. Had it been a case of crossing differences in type would have been expected in the second generation. The chief differences between normal First Early Subterranean Clover and the new variety, if it may be called a new variety, are in colours of the flowers, leaves and stipules.

The normal variety has midway of the leaflet a half-moon shaped light green mark across it, the first broad leaves formed by the young plant have a brown or reddish mark nearer the base of the leaflets than the light mark but this dark mark is not present on the older plants.

The stipules have dark red veins with the red colouration spreading out from the veins.

The flowers are white or a very light pink, if pink it is usually on first opening and the pink colour disappears later.

The variation has dark green leaves quite free of any lighter markings.

The stipules have green veins.

The flowers are salmon pink when open and a light red in the bud.

It is too early to say whether or not this new type is of economic importance, but it is of interest as an instance of variation and it raises the hope that other variations may occur in the existing varieties and that such variations may be improvements in the kind now grown.

FARMERS' TRIALS.

POTATO FERTILISER EXPERIMENT AT BENGER.

J. C. PALMER,
Potato Inspector.

In order to test the effect of varying the quantity of plant food applied as fertiliser to the potato crop, experiments were continued in the summer crop in the Benger Swamp. Through the courtesy of Mr. C. L. Clarke, a portion of his land was used for these trials. The land was of an average type of Benger swamp, which is flooded and remains under water every year during the winter months. This periodic flooding apparently tends to maintain such land in a comparatively high condition of fertility by reason of the deposit of silt in addition to decayed swamp vegetation as the flood waters subside.

The plots were each 1/100th of an acre, and each manurial treatment was repeated six times. The separate plots were arranged in a chequer-board fashion, so that no two plots with the same manurial treatment were together. All the plots received the same treatment in their cultivation, and the manure was applied in the furrow at planting time.

Proper care was taken in the selection and in the pre-planting treatment of the potatoes used in this trial to ensure, as far as possible, that all the plots were planted with the same type of seed of the same degree of maturity. The seed was selected at the time of digging from the previous fertiliser trial at Burekup, which had been planted with "Delaware" potatoes, obtained from Mr. Fred Tonkin, of Young's Siding, from an 18-ton crop. For a period of two months these potatoes were exposed on wire racks under shade in the open. This was done to "green" them thoroughly, and also to afford an opportunity of rejecting any that might have been affected with "storage" or other troubles. Before the potatoes had sprouted they were dipped in the warm formalin dip (which has been outlined in various issues of this Journal). The efficiency of this dip was proved by the resultant tubers being free from scab and rhizoctonia. Whole seed at the rate of approximately 10 cwts. per acre was used in this trial.

An experiment was also conducted, using cut sets, three plots being planted with sets straight "off knife," and three plots with "sets" cut into a wet bag for a period of 24 hours before planting. In a series of experiments, it has been shown that the treatment of cut sets by the "wet bag" method tends to increase the yield.

The land at Benger at planting time is generally inclined to be wet, and consequently cut sets planted straight off the knife may do very well. As a matter of fact, there are many growers who are of the opinion that "wet bagging" is not necessary when the ground is wet at planting time. However, when freshly cut surfaces of the potato are exposed to the soil, there is danger of the leaching out of the sap, and the entry of bacterial or fungoid disease organisms into the "set." This, of course, must tend to

lessen the yield of the subsequent crop. The formation of the protective covering (suberin) over the cut surface when "wet bagged" practically removes this possibility. The table below is a summary of the results obtained:—

Treatment.	Average germination per plot.	Average yield per acre.	Percentage yield.
		tons cwt. qrs. lbs.	%
Wet bag	96	5 17 3 12	103
Off knife	95	5 14 1 4	100

From these results it is noted that there was a slightly higher germination and a greater yield in the plots planted with the treated sets. Though this difference in return is not so large as was the case in some of the former experiments, yet even this is worth taking into consideration. At the ruling price this season, an increase of 3 cwt. per acre represents a cash value of from £2 15s. to £3 per acre, a return which more than repays the very slight extra cost of labour entailed.

The land was in good condition for planting, although rather wetter than usual by reason of the slow evaporation of the flood waters this year. It was ploughed to a depth of 6 inches, and the sets were planted at a uniform depth of 4 inches. Planting was done on January 23. In Benger Swamp little or no subsequent cultivation is carried out, but the plots were twice harrowed, after planting and again about 14 days later. The weather during the growing period was very dry, a factor which must have influenced the yields on the various plots, and tended to minimise the effect of the various mixtures. Rain fell about three weeks prior to digging, but too late to make any material difference in the yields of the plots.

Another factor which influenced the yield was a heavy invasion of cutworms, and the damage was so severe on certain plots that the results obtained from them were not recorded. The plots were treated with a bait, which consisted of 1lb. of Paris green, 30lbs. of bran, and 4lbs. of treacle per acre, and since the invasion was heavy, it would have been profitable to have baited a second time about 10 days subsequent to the first baiting. Probably a sounder system would be to bait just prior to the emergence of the plants. The crop was dug on May 14th and 15th.

In the various trials conducted by the Potato Branch, it has been found tha the "control" mixture has been a very succesful fertiliser. This mixture consists of 1,430 lbs. of Superphosphate, 210 lbs. of Sulphate of Potash and 500 lbs. Sulphate of Ammonia, or approximately 14 cwt. of Superphosphate, 2 cwt. Sulphate of Potash and 5cwt. of Sulphate of Ammonia; in fact, the highest yield per plot (7 tons 15 cwt. 1 qr. 12lbs.), was obtained from one of the "control" plots, and throughout the Potato Fertiliser Trials the results from this mixture have been consistently good.

In the Sulphate of Ammonia Trials, a slight decrease in yield was noted when the quantity of sulphate of ammonia was decreased below that of the

"control" (500lbs. per acre). The table given below shows the results obtained:—

Manuring of Sulphate of Ammonia in lbs. per acre.	Amount of Nitrogen in lbs. per acre.	Average yield per acre.	Percentage yield.
		tons cwt. qrs. lbs.	%
350	70	6 5 0 0	94
500 (control)	100	6 13 0 4	100
200	40	6 7 2 20	96

A consideration of the superphosphate series would seem to show that there was no appreciable difference in yield derived from the application of 1,430 lbs. or 1,907 lbs. of superphosphate per acre. The results obtained are below:—

Manuring of Superphosphate in lbs. per acre.	Amount of Phosphoric Acid in lbs. per acre.	Average yield per acre.	Percentage yield.
		tons cwt. qrs. lbs.	%
1,668	350	6 18 1 16	99
1,430 (control)	300	7 1 0 8	100
1.907	400	7 1 0 8	100

It was interesting to note in the potash series that there was a slight difference in yield from the plots which received no potash in contrast with those with potash. No actual difference, however, was noted between an application of 210 lbs. and 415 lbs. per acre; this may have been due to the lack of rain during the growing season.

Manuring of Potash in lbs. per acre.	Amount of Potash in lbs. per acre.	Average yield per acre.	Percentage yield.
		tons cwt. qrs. lbs.	%
...	...	6 5 0 8	96
210	100	6 18 1 16	100
415	200	6 17 2 0	100

SUMMARY.

1. A good general fertiliser for potatoes in Benger Swamp is 14 cwt. Superphosphate, 5 cwt. Sulphate of Ammonia and 2 cwt. Sulphate of Potash per acre.

2. It is desirable to treat all cut seed by the "wet bag" method prior to planting.

3. Potash should be included in the manuring of potatoes.

4. In seasons when the cut worm is prevalent, it is desirable that the potato plot should be baited at least twice, preferably once before the emergence of the plants, followed by a further application 7 to 10 days later.

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION TESTING SCHEME.

Conducted by Dairy Branch, Department of Agriculture. Year ending 30th June, 1929.

Name of Cow.	Owner.	Breed.	Herd Book No.	Age. Yrs.	Age. Mths.	Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.	Sire.
MATURE COWS—STANDARD 350 LBS. BUTTER FAT.												
				Yrs.	Mths.			lbs.	%	lbs.	lbs.	
Virginia 20th of Darbalara ...	W. G. Burges ...	M.S. ...	14858	5	1	20-9-28	273	10,401	4·41	459·54	12	Expert of Darbalara, 1608
Tipperary Mona	do.	Ayrshire ...	6165	9	2	20-8-28	273	10,077	4·46	450·16	19	Loudon of Oakbank, 2553
Starbrights Duchess of Glen Iris...	Mrs. B. Burnside	Jersey ...	14176	5	0	26-9-28	273	7,759	5·63	436·83	16½	Sweetbread's Duke of Glen Iris, 1918
Royal's Lamelie of Wangara ...	W. G. Burges ...	M.S. ...	14560	5	1	5-8-28	273	9,775	4·26	417·21	18½	Royal of Arrawatta, 555
Carnation 3rd of Greyleigh	E. McManus ...	do. ...	Vol. 8	6	7	2-8-28	273	11,820	3·40	402·52	20	Foch of Greyleigh
Yarraview Bonnie	A. W. Padbury ...	Guernsey...	781	8	2	8-9-28	273	7,047	5·61	395·49	19	Yarraview Glory De Joia, 218
Lily of Roelands	G. F. Coombs ...	Jersey ...	10619	7	11	23-7-28	273	8,122	4·63	376·15	7½	Bull Oak of Tarnfirr, 1887
Gladness 2nd of Wollongbar...	Dept. of Agriculture	Guernsey...	631	6	10	5-3-28	273	6,339	5·70	361·80	13	Faithful Fido of Wollongbar, 81
Topsy Rye of Grass Vale ...	C. H. Ironmonger ...	Jersey ...	15702	5	1	21-7-28	273	6,365	5·60	356·76	11½	Rye Duke of Glen Iris, 1994
Colleen of Rosewood	Dept. of Agriculture	Guernsey...	819	6	9	11-10-28	273	6,471	5·20	337·05	12	Archer of Nundorah, 76
Clare 2nd of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	7	0	25-9-27	273	8,304	3·98	330·50	13	Morven York Rose, 5th
Makanora of Grass Vale ...	C. H. Ironmonger...	Jersey ...	12257	5	11	26-5-28	273	6,369	4·97	317·09	18	Makarini, 995
Velvet of Wollongbar	Dept. of Agriculture	Guernsey...	774	7	5	9-10-27	273	7,704	4·08	314·50	18	Faithful Fido of Wollongbar, 81
Golden Pearl 4th of Wollongbar	Dept. of Agriculture	do. ...	863	5	11	1-2-28	240	5,970	5·22	311·85	17	Judge of Wollongbar, 184
Aberbechan Rosebud	E. V. Pailthorpe ...	Red Poll ...	1096AA	5	4	17-4-28	210	7,170	4·17	298·95	30	Basildon Redmond, 224AA
Bonnet II. of Berry	W. G. Burges ...	M.S. ...	13168	5	4	11-1-28	273	6,603	4·48	295·17	21	Newhaven of Darbalara, 1174
Minnamurra Holly	Muresk Agricultural College	Guernsey...	953	5	4	7-5-28	273	6,501	4·39	285·30	17	Minnamurra's Favourite Prince, 294
Parson's Red Rose 31st of Wollongbar	Dept. of Agriculture	do. ...	985	5	3	1-3-28	273	5,530	5·13	283·75	18½	Rose Boy of Wollongbar, 316
Aberbechan Molly	E. V. Pailthorpe ...	Red Poll ...	1090AA	5	3	29-4-28	210	7,440	3·79	282·27	33	Basildon Redmond, 224AA
Virginia 18th of Darbalara ...	W. G. Burges ...	M.S. ...	14857	5	4	7-2-28	273	6,342	4·37	277·28	19	Windsor of Darbalara, 1444
Virginia of Nundorah	Dept. of Agriculture	Guernsey...	778	7	0	6-10-27	273	5,373	4·89	263·14	11	Warrior of Nundorah, 322
Dinah 2nd of Wollongbar	do.	do. ...	832	5	1	29-3-28	273	5,676	4·54	257·96	12	Judge of Wollongbar, 184
Aberbechan Cherry	E. V. Pailthorpe ...	Red Poll ...	1088AA	5	4	3-7-28	150	6,690	3·82	255·96	41	Basildon Redmond, 224AA
Morden Lady 2nd of Koojan ...	A. W. Padbury ...	Guernsey ...	918	5	2	25-10-27	273	4,677	5·09	238·42	4	Gay Lad's Golden Dawn of Guildford,
Virginia of Nundorah	Dept. of Agriculture	do. ...	778	7	11	25-9-28	273	4,983	4·39	218·35	11	Warrior of Nundorah
Pretty Polly II. of Cowra ...	W. G. Burges ...	M.S. ...	14414	5	5	8-1-28	210	4,590	4·47	205·16	16	Newhaven of Darbalara, 1174
Golden Cream 3rd of Roelands	Mrs. B. Burnside ...	Jersey ...	15690	5	2	14-8-28	240	3,135	5·98	187·71	6	Brown Fern of Glen Iris, 1364
Jean II. of Grass Vale ...	G. F. Coombs ...	do. ...	9996	7	8	6-5-28	150	2,730	5·80	158·34	13½	Noble Fondant of Garden Hill, 2268

COWS OVER 4½ YEARS AND UNDER 5 YEARS—STANDARD 325 LBS. BUTTER FAT.

Aberbechan Rosemary 3rd ...	V. D. Pailthorpe ...	Red Pole...	1098AA	4	10	25-4-28	273	9,294	4·23	393·40	28	Basildon Redmond, 224 AA
Koojan Rosebud	A. W. Wilson ...	Guernsey...	1260	4	8	29-5-28	273	6,846	5·02	343·81	17	Robin of Nundorah, 417
Cream Duchess of Grass Vale ...	G. F. Coombs ...	Jersey ...	17531	4	9	3-7-28	273	5,818	5·48	319·30	4½	Rye Duke of Glen Iris, 1994
Baronia Rye of Grass Vale ...	C. H. Ironmonger ...	do. ...	17529	4	8	26-4-28	273	6,630	4·72	312·88	20	Rye Duke of Glen Iris, 1994
Aberbechan Mary	V. D. Pailthorpe ...	Red Pole...	1358AA	4	9	19-4-28	210	8,055	3·49	281·61	36	Basildon Redmond, 224 AA
Priscilla 10th of Darbalara ...	W. G. Burges ...	M.S. ...	14457	4	11	14-9-28	273	6,076	4·38	266·11	5½	Melbourne of Darbalara, 1142
Wollongbar Realm 2nd ...	Muresk College ...	Guernsey...	1151	4	7	16-6-28	273	4,449	4·74	211·10	8	Bellman of Wollongbar, 334
Jean Rye of Grass Vale ...	C. H. Ironmonger	Jersey ...	15691	4	11	30-7-28	150	3,690	4·23	156·33	19	Rye Duke of Glen Iris, 1994

COWS OVER 4 YEARS AND UNDER 4½ YEARS—STANDARD 300 LBS. BUTTER FAT.

Matilda 7th of Berry	W. G. Burges ...	M.S. ...	14074	4	3	2-4-28	273	9,825	4·36	428·32	30	Rutland of Darbalara, 575
Dahlia 5th of Berry	do.	do. ...	Vol. 8	4	1	21-3-28	273	7,680	4·23	325·64	8	Mirth of Berry, 1716
Daisy Bell of Koojan ...	A. W. Wilson ...	Guernsey...	824	4	5	22-11-27	273	5,802	5·42	314·86	14	Gay Lad's Golden Rule, 247
Golden Rye of Grass Vale ...	R. H. Rose ...	Jersey ...	18566	4	1	15-9-28	273	5,184	5·82	302·07	8	Rye Duke of Glen Iris, 1994
Dover 5th of Kelvin Park ...	Hospital for Insane Claremont	M.S. ...	Vol. 8	4	1	9-11-27	273	6,189	4·49	278·29	8	Daddy Xmas of Croobyar, 928
Wollongbar Dessie 2nd ...	Muresk Agricultural College	Guernesy...	1121	4	1	9-5-28	273	4,969	5·20	258·62	11½	Renown of Wollongbar, 415
Koojan Lady Beatrice ...	Dept. of Agriculture	do. ...	1258	4	3	3-9-28	273	5,109	4·83	247·16	8	Robin of Nundorah, 417
Wollongbar Modesty 2nd ...	Muresk Agricultural College	do. ...	1134	4	5	10-7-28	273	4,320	5·06	218·70	10	Bounty of Wollongbar, 336
Koojan Bonnie Princess ...	Dept. of Agriculture	do. ...	1251	4	1	28-6-28	210	3,030	5·73	173·88	7	Golden King of Koojan, 369

COWS OVER 3½ YEARS AND UNDER 4 YEARS—STANDARD 275 LBS. BUTTER FAT.

Maggie Rye of Grass Vale ...	R. H. Rose ...	Jersey ...	19113	3	7	15-5-28	273	6,924	5·37	372·11	13	Rye Duke of Glen Iris, 1994
Rose 18th of Darbalara ...	W. G. Burges ...	M.S. ...	NYA	3	7	7-4-28	273	7,680	4·42	339·67	20	Victor of Darbalara, 2384
Koojan Dulcie	A. W. Padbury ...	Guernsey...	1255	3	9	13-1-28	273	5,705	5·68	324·06	18½	Robin of Nundorah, 417
Jessie Lind of Grass Vale ...	Dr. B. Burnside ...	Jersey ...	17965	3	10	27-3-28	273	4,420	5·90	260·99	13½	Rye Duke of Glen Iris, 1994
Spurfield Air Girl 2nd ...	Muresk Agricultural College	Guernsey...	1048	3	7	19-11-27	273	4,023	5·31	213·86	16	Milton's Stedfast, 292
Noreen 3rd of Garden Hill ...	W. Padbury ...	Jersey ...	17952	3	7	7-4-28	273	3,500	5·38	188·59	11½	Reformer of Garden Hill, 2732
Spurfield Angelica 2nd ...	Muresk Agricultural College	Guernsey...	1051	3	7	26-6-28	273	3,253	5·37	174·97	9½	Milton's Stedfast, 292

COWS OVER 3 YEARS AND UNDER 3½ YEARS—STANDARD 250 LBS. BUTTER FAT.

Melba 69th of Darbalara ...	W. G. Burges ...	M.S. ...	Vol. 8	3	5	19-4-28	273	8,679	4·56	395·83	23	ReEcho of Darbalara, 2254
Koojan Lady Buller	A. W. Wilson ...	Guernsey ..	1259	3	2	19-9-28	273	6,009	5·85	351·88	18	Robin of Nundorah, 417
Denmark Anne	Dept. of Agriculture	do. ...	1164	3	4	2-7-28	273	6,648	5·16	342·97	16	Linwood of Wollongbar, 381
Golden Rye of Grass Vale ...	R. H. Rose ...	Jersey ...	18566	3	2	21-10-27	273	5,359	6·05	324·34	6½	Rye Duke of Glen Iris, 1994
May of Wooroloo	Sanatorium Farm ...	M.S. ...	Vol. 8	3	0	31-8-28	273	6,064	4·35	263·87	16½	Commercial of Blackheath, 2001
Tessie of Garden Hill ...	W. Padbury ...	Jersey ...	17957	3	5	25-3-28	273	4,309	5·97	257·38	11½	Cream Socks of Glen Iris, 1410
Wollongbar Bonnie Pearl ...	Dept. of Agriculture	Guernsey...	1165	3	5	23-11-27	273	4,720	5·40	255·03	18½	Bounty of Wollongbar, 336
Spurfield Alma	Muresk Agricultural College	do. ...	1049	3	5	4-4-28	273	4,450	4·82	214·89	13½	Milton's Steadfast, 292

HERD TESTING—*continued.*

Name of Cow.	Owner.	Breed.	Herd Book No.	Age. Yrs.	Age. Mths.	Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.	Sire.
HEIFERS OVER 2½ YEARS AND UNDER 3 YEARS—STANDARD 225 LBS. BUTTER FAT.												
								lbs.	%	lbs.	lbs.	
Yes of Woodlands	A. W. Wilson ...	Guernsey...	...	2	7	22-2-28	273	9,024	4·28	386·63	28	Renown of Koojan, 414
Lady Fowler 3rd of Grass Vale	R. H. Rose ...	Jersey ...	19111	2	8	4-2-28	273	6,349	5·82	369·59	21½	Rye Duke of Glen Iris, 1994
Brookvale Noble Lass ...	G. F. Coombs ...	do. ...	20866	2	11	2-7-28	240	3,915	5·97	233·76	5	Noble Lad of Roelands, 3707
Stella 3rd of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	6	9-7-28	273	6,762	3·44	232·73	19	Searchlight of Sunnyvale
Biddy 5th of Claremont ...	do. ...	do. ...	Vol 8	2	11	4-12-27	273	5,403	4·24	229·01	16	Telyarup Prince of Claremont, 2352
Silvermine 2nd of Garden Hill	W. Padbury ...	Jersey ...	20879	2	11	16-9-28	273	3,544	5·57	197·79	6½	Cream Socks of Glen Iris, 1410
Snowflake of Tipperary ...	W. G. Burges ...	M.S. ...	Vol. 8	2	6	21-2-28	273	3,382	4·30	145·64	7½	Express of Darbalara
HEIFERS UNDER 2½ YEARS—STANDARD 200 LBS. BUTTER FAT.												
Koojan Morden Lady 4th ...	A. W. Padbury ...	Guernsey...	1901	1	10	27-7-28	273	5,754	5·90	340·03	18	Robin of Nundorah, 417
Lady Fowler 4th of Grass Vale	R. H. Rose ...	Jersey ...	23690	2	3	26-10-27	273	5,437	5·81	315·92	17½	Starbrights Sweet Duke of Glen Iris, 3710
Koojan Wavelet	A. W. Padbury ...	Guernsey...	1619	2	0	16-8-28	273	5,823	5·34	311·96	21	Robin of Nundorah, 417
Koojan Rose	do. ...	do. ...	1617	2	4	25-8-28	273	5,280	5·85	308·12	15	Koojan Golden Governor, 595
Crantock Lady Lily	Mrs. Burnside ...	Jersey ...	NYA	1	7	11-6-28	273	5,236	5·83	305·55	15½	Starbright's Sweet Duke of Glen Iris, 3710
Koojan Dorothy	A. W. Padbury ...	Guernsey...	1613	2	2	31-8-28	273	5,550	5·43	301·30	20	Koojan Golden Governor, 595
Carnation of Minnathorpe ...	E. McManus ...	M.S. ...	Vol. 8	2	1	11-6-28	273	6,523	4·50	294·02	19½	Bruce of Sunnyvale
Brookvale Noble Queen ...	G. F. Coombs ...	Jersey ...	NYA	2	2	17-8-28	273	5,460	5·35	292·53	10	Noble Lad of Roelands, 3707
Maggie of Claremont	Hospital for Insane	M.S. ...	Vol. 8	2	5	30-8-28	273	7,555	3·72	281·16	18½	Searchlight of Sunnyvale
Wing Wing of Wooroloo ...	Sanatorium Farm ...	do. ...	...	2	1	28-7-28	273	6,793	4·03	274·16	19½	Eclipse of Wooroloo
Golden Cream 2nd of Grass Vale	R. H. Rose ...	Jersey ...	NYA	2	5	21-9-28	273	4,851	5·63	273·29	12	Rye Duke of Glen Iris, 1994
Mabel 2nd of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	3	31-8-28	273	6,132	4·32	264·94	19	Telyarup Prince of Claremont, 2352
Koojan Colleen	A. W. Wilson ...	Guernsey...	1293	2	2	16-10-27	273	5,418	4·75	257·51	16	Robin of Nundorah, 417
Denmark Rosa	Dept. of Agriculture	do. ...	1429	2	3	3-3-28	273	5,019	5·12	257·27	18	Rose Chief of Wollongbar, 130
Koojan Iris	A. W. Padbury ...	do ...	1614	1	11	10-7-28	273	4,060	6·20	251·98	13½	Robin of Nundorah, 417
Cocky 5th of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	3	19-3-28	273	6,619	3·78	250·51	16½	Telyarup Prince of Claremont, 2352
Fessie 2nd of Claremont ...	do.	do. ...	Vol. 8	2	3	20-8-28	273	6,118	3·98	244·02	19½	Rocket of Glenburn
Lady Minta Gem 8th of Garden Hill	W. Padbury ...	Jersey ...	20877	2	2	13-1-28	273	4,417	5·51	243·49	12½	Financier of Garden Hill, 4013
Kathleen 5th of Kurrawong ...	W. G. Burges ...	M.S. ...	Vol. 8	2	2	20-2-28	273	6,391	3·77	241·45	20½	Premier of Kurrawong, 1212
Flynn 7th of Claremont ...	Hospital for Insane	do. ...	Vol. 8	2	3	17-12-27	273	5,640	4·17	235·45	10	Telyarup Prince of Claremont, 2352
Blanche 5th of Minnathorpe ...	E. McManus ...	do. ...	Vol. 8	2	2	13-7-28	273	6,183	3·79	234·53	11	Collier of Darbalara, 1997
Spring Park Rye Queen ...	C. H. Ironmonger	Jersey ...	NYA	1	9	26-4-28	273	4,539	5·13	232·90	13	Rye Duke of Glen Iris, 1994
Brookvale Noble Lily ...	G. F. Coombs ...	do. ...	NYA	2	1	4-9-28	240	4,725	4·92	232·77	11	Noble Lad of Roelands, 3707

Rose of Wooroloo	Sanatorium Farm...	M.S. ...	Vol. 8	2	2	22-2-28	273	5,305	4·38	232·50	18¼	Commercial of Blackheath, 2001
Sweet Duchess of Grass Vale ...	R. H. Rose ...	Jersey ...	23692	2	2	17-11-27	273	4.041	5·62	227·19	12	Starbrights Sweet Duke of Glen Iris, 3710
Hilda 2nd of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	5	10-9-28	273	5,889	3·74	220·44	18	Starlight of Sunnyvale Searchlight
Star Lady of Grass Vale ...	R. H. Rose ...	Jersey ...	NYA	2	2	5-10-28	273	4,221	5·22	220·32	12	Carnation's Masterpiece of Garden Hill, 2065
Dover 1st of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	3	6-9-28	273	5,152	4·26	219·45	12½	Rocket of Glenburn
Denmark Rose Velvet ...	Dept. of Agriculture	Guernsey ...	1431	2	0	10-10-27	273	3,813	5·70	217·59	11	Rose Chief of Wollongbar, 130
Mavis of Claremont	Hospital for Insane	M.S. ...	Vol. 8	2	3	3-3-28	273	6,007	3·58	215·51	17½	Telyarup Prince of Claremont, 2352
Brookvale Noble Girl	G. F. Coombs ...	Jersey ...	NYA	2	0	26-8-28	240	4,365	4·72	206·40	8	Noble Lad of Roelands, 3707
Biddy 6th of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	5	26-4-28	273	5.394	3·69	199·16	8	Telyarup Prince of Claremont 2352
Whitby Maid 5th of Claremont	do. do.	do. ...	Vol. 8	2	3	4-7-28	273	4,506	4·37	197·30	12	Searchlight of Sunnyvale
Tessie 2nd of Garden Hill ...	W. Padbury ...	Jersey ...	20880	2	1	14-12-27	273	2,869	6·64	190·53	11⅓	Cream Socks of Glen Iris, 1410
Blanche 6th of Claremont ...	Hospital for Insane	M.S. ...	Vol. 8	2	1	22-2-28	273	4,798	3·60	172·90	14½	Telyarup Prince of Claremont, 2352
Pride 4th of Kurrawong ...	W. G. Burges ...	do. ...	Vol. 8	2	2	31-1-28	273	4,887	3·52	172·33	14	Premier of Kurrawong, 1212
Ice Cream 2nd of Garden Hill	W. Padbury ...	Jersey ...	NYA	2	0	4-1-28	273	2.185	6·06	132·44	8½	Cream Socks of Glen Iris, 1410
Aberbeshan Rosemary 5th ...	E. V. Pailthorpe ...	Red Poll ...	1361AA	2	1	20-7-28	120	3,240	3·71	120 33	24½	Basildon Redmond, 224AA

FRUIT THINNING.

GEO. W. WICKENS,
Superintendent of Horticulture.

Undersized fruit, that is fruit which is much below the average normal size for the variety, is essentially poor in quality and plain in appearance, lacking juice and flavour, form and colour.

This is true of all kinds and varieties, but there are some fruits in cultivation where the difference between good grade and undersized means a difference in price representing a handsome return, compared with a dead loss.

At the auction rooms in Perth this month (August, 1929) good grade "Yates" apples, ranging in size from 2¼ inches to 2½ inches were sold for 14s. to 19s. per case, while in the same markets on the same days the same variety under 1½ inches were sold for 2s. per case, and though this latter price meant a loss to the growers it was a great deal more than the fruit was worth.

A similiar experience can be noted each year when the early stone fruits are marketed. "Newcastle" apricots, and peaches of the "Bell's November," "Edward VII." and "Dunhelm" class, largely grown in districts near Perth, are when undersized, almost unsaleable, the apricots being mostly stone, and the peaches' principle characteristics comprising a hairy skin and bitter flavour: but when these wretched specimens of some fruitgrower's lack of skill are being offered to buyers who refuse to be interested, the same varieties, grown to proper size by other growers, are subject to spirited bidding and realise high prices.

The varieties named are quoted as instances of some that suffer badly through allowing the trees to over-crop, but as stated above undersized fruit is poor fruit, irrespective of kind or variety, and the pity is that every season so much is in evidence when prevention is so easy.

If fruit trees are kept in a healthy condition of growth by attention to cultivation and manurial requirements of the soil, over-cropping is the only factor (apart from disease or drought) that will cause the fruit produced by those trees to be undersized, and the grower who has such fruit with difficult sales and low values has only himself to blame.

With deciduous trees, particularly those which have been bearing for a considerable number of years, winter pruning plays an important part in preventing overcropping. Fruit buds both on spurs and lateral growths should be reduced and spaced so as to prevent as far as possible the remaining buds from being crowded together: but no matter how carefully and well winter pruning is carried out it will be found in a normal season on a majority of trees thinning young fruits is essential before size and quality can be obtained. No loss in quantity need be feared from thinning if the work is properly carried out, for the lesser number of well grown fruits will fill as many cases as the greater number of undersized fruits. Another point also worth taking into consideration is the fact that thinning does not increase the year's work in the orchard: on the contrary it lessens it, for the fruits picked off in their early stages of growth are only handled

once, being thrown on the ground as soon as picked, but if left on the trees to mature they still have to be gathered and in addition packed in cases for market.

In thinning stone fruits—peaches, nectarines, apricots and plums—the operation should be delayed until after the natural shedding has taken place, which occurs according to variety from about the middle of October to the middle of November.

No hard and fast rule can be laid down as to the number to take off: the usual advice with peaches and apricots is to space the fruits about four inches apart, but trees rarely crop evenly enough to allow of this being made a rule, and the result aimed at should be to thin in such a way that each fruit is allowed sufficient room to develop to a good size for the variety without touching its neighbour.

Apples and pears grow in clusters, at times as many as five together, and as a general rule these should be thinned to two in each cluster, but the operator must exercise judgment according to whether the fruit buds are close together or a fair distance apart—for instance on aged "Yates" trees with fruit buds clustered on ramified spurs along the leaders, one apple to each bud is ample, and if spur pruning has been neglected in winter and buds are very close together every fruit should be removed from a number of them. The great art of thinning lies in even spacing of fruits, for half the apples could be picked off a tree and no good result be obtained if those remaining were clustered in bunches.

In thinning apples and pears, which as stated above grow in clusters, care must be taken when removing the fruits to leave the stems attached to the trees. If the stems are taken off with the fruits, the whole cluster is weakened, and the remaining fruits are liable to fall off at a later date. With practice it is comparatively easy to take hold of an apple and bend it upwards in such a way that the stem parts readily from the fruit, but this can be done only if thinning is being carried out when the fruits are still quite small, or are naturally long stemmed varieties. If they are short stemmed, like for instance, "Jonathans" and the apples in the cluster are tightly touching each other, it is nearly impossible to remove one with fingers without endangering the safety of those left behind. A small pair of scissors with blunt points makes a useful tool: a lemon clips is also satisfactory, or a sharp budding knife in skilful hands performs the work rapidly and well.

SUMMARY.

(a) Undersized fruit is poor in quality and appearance, and is either unsaleable or saleable only at prices that are non-remunerative:

(b.) Undersized fruit is mainly due to over-cropping.

(c.) Over-cropping can be prevented by reducing fruit buds in winter and thinning young fruits in early summer:

(d.) Efficient orchardists do not allow their trees to produce undersized fruit—inefficient orchardists should emulate their example—By their fruits ye shall know them.

CHAPMAN EXPERIMENT FARM.

JUNIOR FIELD TRIALS, 1928.

D. R. BATEMAN
(Seedsman.)

WHEAT VARIETIES.

The trials were planted on similar lines to those of previous years. Each variety was sown down two tubes of the drill, a drill width containing five varieties with the control variety Nabawa on either side.

The length of the plots as planted was 10 chains, this later being subdivided into 10 sections, each 87 links long with a division of 4 links between each section, the balance of the plot being left to form a headland.

Three of these sections were harvested for hay, six for grain and one was left standing, so that information regarding the strength of straw and ability of the different varieties to hold their grain could be obtained.

Seeding was carried out under ideal conditions on 19th May. Germination was excellent throughout the whole of the experiments.

Thirty-five varieties were included in the trial, 26 of these being apparently fixed cross-breds from the Merredin and Chapman Experiment Farms.

Of the remainder, there are seven from the Eastern States, which have shown promise here in the Test Rows, and two named cross-breds—Ogilvie and Bowes—bred at this farm. These latter two are midseason varieties of fair promise.

The results of the trials, as given in the following tables, are of use only as an indication of the possible comparative productivity of the different varieties. Every care is taken to keep the yields as accurate as possible, but the loss in threshing is too irregular for any definite yield per acre to be stated.

The area harvested per section of any one variety is approximately 1/640th of an acre, the total area per variety being:—6/640ths of an acre for grain and 3/640ths of an acre for hay.

The plots are harvested by hand, each section and variety being cut separately and the sheaf or sheaves labelled.

For hay the varieties are cut as near as possible at the same stage of maturity, and the sheaves stooked in the paddock until sufficiently dry for carting. Each sheaf is then weighed to the nearest ¼lb. and the weights recorded.

For grain the varieties are not cut until they would be fit for stripping. When cut the sheaves are stooked until it is convenient to thresh them by means of a small peg-drum thresher and winnower machine.

The yield of grain from each section is naturally very small and to get the results of the trial as accurate as possible, weights are taken to the nearest ⅛th of an ounce.

RELATIVE YIELDS OF HAY AND GRAIN FOR 1927 AND 1928.

Reg. No. P.	Name of Variety or parent varieties of Cross-breds.	Maturity.	Average height, inches.	1928.		1927.	
				Grain.	Hay.	Grain.	Hay.
				%	%	%	%
M31	Gluyas Early x Nabawa ...	Midseason ...	45	125	136	...	...
1192	Ford	do. ...	50	116	155	135	144
M26	Nabawa x Carrabin ...	Early	42	111	127	...	...
1700	Alliance	do. ...	41	107	102	95	100
1614	Bena	Midseason ...	46	106	159	86	126
C84	D.A.C. 4179 x Nabawa ...	Early	46	103	109	...	...
1697	Ranee	do. ...	40	102	126	96	111
1463	Patriot	do. ...	43	101	123	100	132
1432	Nabawa—Control	Midseason ...	45	100	100	100	100
1804	Bowes	do. ...	45	100	113	88	126
1803	Ogilvie	do. ...	46	100	144	76	161
C76	Minister x Toby's Tusk ...	do. ...	45	100	147	...	...
M33	Florence x Nabawa ...	Very Early ...	44	98	124	...	...
M 3	Toby's Tusk x Nabawa ...	Midseason ...	44	95	105	120	142
1609	Nugget	do. ...	45	94	123	104	118
1696	Confederation	Early	40	94	105	111	131
M24	Florence x Carrabin ...	do. ...	43	94	115	...	...
C46	Minister x Toby's Tusk ...	Midseason ...	44	93	95	99	105
C77	Florence x Carrabin ...	Early	43	93	119	...	...
C51	Toby's Tusk x Gluyas Early	do ...	41	92	122	117	132
C52	Nabawa x Gluyas Early ...	do. ...	42	90	125	118	132
C68	Currawa x Gluyas Early ...	Late	47	88	146	100	137
C47	Minister x Toby's Tusk ...	Midseason ...	45	88	104	81	100
M28	Dindiloa x Nabawa ...	Early	40	88	106	...	...
C59	Nabawa x Bunyip	do. ...	45	88	112	119	121
C69	Warren x Bayah	do. ...	43	88	87	116	112
C61	Federation x Bunyip ...	Late	43	85	81	99	118
M25	Nabawa x Carrabin ...	Early	42	85	86	...	...
C80	Dindiloa x Nabawa ...	do. ...	43	80	124	...	...
C56	Currawa x Cowra 15 ...	Late	42	79	117	123	126
M30	Dindiloa x Nabawa ...	Early	40	79	111	...	...
M4	Steinwedel x Cedar ...	do. ...	46	77	100	105	111
C86	Florence x Velvet Don ...	Late	46	76	157	...	...
C60	Nabawa x Bunyip	Midseason ...	42	75	67	119	132
C81	Florence x Nabawa ...	Early	46	71	82	...	...
M23	Federation x Carrabin ...	do. ...	42	68	78	...	...

BRIEF NOTES ON CHARACTERISTICS OF EACH VARIETY.

Alliance P. 1700.

Type:—White, square-tipped bald ear. Fairly short, stout straw that stands very well. Indifferent hay quality. Poor grain sample; dull, discoloured and slightly pinched.

Diseases:—Susceptible to Rust, Bunt, Septoria and Flag Smut.

Bena P. 1614.

Type:—Brown, slightly tapering, tip-awned ear. Stout straw that stands well. Indifferent quality hay. Has shed rather badly this season. Very good grain sample.

Diseases:—Susceptible to Bunt, Septoria, Rust and Flag Smut.

Bowes P. 1804.

Type:—White, tapering, tip-awned ear. Stout straw that stands well. Fair hay qualities. Sheds very little. Fairly good grain sample.

Diseases:—Susceptible to Bunt and Rust; moderately susceptible to Flag Smut.

Confederation P. 1696.

Type:—White, slightly clubbed, tip-awned ear. Stout straw that stands well. Indifferent hay qualities. Sheds rather badly. Unattractive grain sample, and a small percentage shrivelled.

Diseases:—Susceptible to Bunt and Rust. Fairly resistant to Flag Smut and Septoria.

Ford P. 1192.

A tall growing, dual purpose variety, that sheds very badly.

Type:—White, tapering, tip-awned ear. Tall, medium to stout straw, that stands fairly well. Yields well for hay, which is of good quality. Good for grain, but sheds badly.

Diseases:—Moderately susceptible to Rust and Septoria. Resistant to Flag Smut.

Nugget P. 1609.

Type:—White, square, slightly tip-awned ear, with rather a showy head, but very chaffy. Fairly tall, purple straw, that stands well. Fairly good for hay. Sheds badly.

Diseases.—Very susceptible to Bunt. Susceptible to Flag Smut and Rust. Moderately susceptible to Septoria.

A late variety that showed promise in the Test Row plantings, but failed under field conditions. Not worth continuing with..

Ogilvie P. 1803.

Type:—Brown, tapering, tip-awned ear. Fairly tall, stout straw that stands fairly well. Good quality hay. Sheds a little. Fairly good grain sample.

Diseases:—Moderately susceptible to Bunt, Septoria and Flag Smut. Susceptible to Rust.

Patriot P. 1463.

Type:—White, tapering bald ear. Fairly tall, medium straw. Fairly good hay qualities, but sheds badly.

Diseases:—Very susceptible to Bunt. Susceptible to Rust and moderately susceptible to Septoria and Flag Smut.

Ranee P. 1697.

Type:—Brown, tapering, tip-awned ear. Stout straw, that stands well. Indifferent quality hay. Sheds badly.

Diseases:—Moderately susceptible to Rust, Bunt, Septoria and Flag Smut.

C. 46 (***Minister x Toby's Tusk***).

Type:—White, tapering, tip-awned ear. Tall, stout straw, having fair hay qualities. Inclined to lodge badly. Sheds badly. Good grain sample.

Diseases:—Resistant to Bunt. Fairly resistant to Flag Smut. Moderately susceptible to Septoria and Rust.

Has not yielded up to expectations. Not worth continuing with.

C. 47 (*Minister x Toby's Tusk*).

Type:—White, slightly tapering, tip-awned ear. Tall medium straw, inclined to lodge badly. Sheds badly. Good grain sample.

Diseases:—Susceptible to Bunt and Flag Smut. Moderately susceptible to Rust.

Has not yielded up to expectations, and is not worth continuing with.

C. 51 (*Toby's Tusk x Gluyas Early*).

Type:—White, square tip-awned ear. Medium stout straw. Fairly good quality hay. Sheds very little. Good grain sample.

Diseases:—Very susceptible to Bunt. Moderately susceptible to Rust Septoria and Flag Smut.

A fairly promising variety. Consistent yielder for both hay and grain.

C. 52 (*Nabawa x Gluyas Early*).

Type:—Brown, tapering, tip-awned ear. Medium straw that stands very well. Good hay qualities. Does not shed. Good grain sample.

Diseases:—Very susceptible to Bunt. Susceptible to Flag Smut. Moderately susceptible to Septoria and Rust.

C. 56 (*Currawa x Cowra* 15).

Type:—White, clubbed, tip-awned ear. Fairly tall, stout straw that stands well. Indifferent hay qualities. Does not shed. Good grain sample.

Diseases:—Very susceptible to Bunt. Moderately susceptible to Septoria and Rust. Fairly resistant to Flag Smut.

A promising late variety that failed to yield up to expectations. Not worth continuing with.

C. 59 (*Nabawa x Bunyip*).

Type:—White, tapering ear, with short tip awn. Fairly tall, stout straw, inclined to lodge. Only fair hay qualities. Does not shed. Good grain sample.

Disease:—Fairly resistant to Bunt. Moderately susceptible to Rust and Septoria. Resistant to Flag Smut.

Similar type variety to Nabawa, but somewhat inferior. Not worth continuing with.

C. 60 (*Nabawa x Bunyip*).

Similar to C. 59, but does not yield as well. Not worth continuing with.

C. 61 (*Federation x Bunyip*).

Type:—Brown, tapering bald ear. Medium straw that stands well. Good quality hay. Sheds a little. Good grain sample.

Diseases.—Fairly resistant to Bunt, moderately susceptible to Septoria and Rust. Resistant to Flag Smut.

C. 68 (*Curawa x Gluyas Early*).

Type:—White, tapering, tip-awned ear. Tall medium to stout straw, that stands well. Good quality hay. Does not shed. Fair grain sample.

Diseases:—Very susceptible to Bunt. Slightly susceptible to Septoria. Moderately susceptible to Rust. Resistant to Flag Smut.

A good variety, that yields fairly well for grain.

C. 69 (*Warren x Bayah*).

Type:—White, square bald ear, rather compact. Straw medium stout, stands well. Fair hay qualities. Sheds a little. Nice grain sample.

Diseases:—Susceptible to Bunt, Rust and Flag Smut. Slightly susceptible to Septoria.

C. 76 (*Minister x Toby's Tusk*).

Type:—White, clubbed, partly bearded ear. Stout straw of indifferent hay qualities. Inclined to lodge badly. Fair grain yielder, inclined to shed. Good grain sample.

Diseases:—Fairly resistant to Bunt, susceptible to Rust and Flag Smut.

A tall growing variety that gave good promise in Test Row plantings. Not worth continuing with.

C. 77 (*Florence x Carrabin*).

Type:—White, tapering, bald ear. Medium stout straw, inclined to lodge. Good quality hay. Does not shed. Good grain sample for milling.

Diseases:—Resistant to Flag Smut and Bunt. Moderately susceptible to Septoria and Rust.

C. 80 (*Dindiloa x Nabawa*).

Type:—White, tapering, tip-awned ear. Medium stout straw that stands very well. Good quality hay. Does not shed. Fair grain sample. Hard to thresh.

Diseases:—Resistant to Bunt and Flag Smut. Slightly susceptible to Bunt and Septoria.

C. 81 (*Florence x Nabawa*).

Type:—White, tapering, tip-awned ear. Medium stout straw that stands very well. Good hay qualities. Does not shed. Good grain sample.

Diseases:—Fairly resistant to Bunt, Septoria and Rust. Resistant to Flag Smut.

C. 84 (*D.A.C.* 4179 *x Nabawa*).

Type:—White, tapering ear, similar to Nabawa. Tall stout straw that stands fairly well. Indifferent hay quality. Does not shed. Unattractive grain sample.

Diseases:—Very susceptible to Bunt. Moderately susceptible to Rust and Septoria. Resistant to Flag Smut.

C. 86 (*Florence x Velvet Don*).

Type:—White, tapering, tip-awned ear. Tall medium straw of good hay quality. Stands very well. Does not shed. Grain bright. Slightly shrivelled.

Diseases:—Resistant to Bunt and Flag Smut. Moderately susceptible to Rust and Septoria.

M. 3 (*Toby's Tusk x Nabawa*).

Type:—White, slightly clubbed, tip-awned ear. Tall straw. Inclined to lodge. Hay of fairly good quality. Sheds badly. Unattractive grain sample.

Diseases:—Moderately susceptible to Bunt and Rust. Resistant to Flag Smut.

A tall variety that yielded much better in 1927 than this season. Not worth continuing with. Very weak straw.

M. 4 (*Steinwedel x Cedar*).

Type:— White, clubbed, tip-awned ear. Fairly tall, stout straw that goes down badly. Does not shed. Fair grain sample.

Diseases:—Slightly susceptible to Rust and Septoria.

A fair dual purpose variety. Weak in the straw. Not worth continuing with.

M. 23 (*Federation x Carrabin*).

Type:—White, tapering bald ear. Medium straw that stands well. Fair hay qualities. Does not shed. Unattractive grain sample.

Diseases:—Fairly resistant to Bunt and Flag Smut. Moderately susceptible to Rust and Septoria.

An early variety that showed fair promise under Test Row conditions, but failed in field test.

M. 24 (*Florence x Carrabin*).

Type:—White, tapering bald ear. Medium straw, inclined to lodge a little. Fairly good hay qualities. Sheds badly. Attractive grain sample.

Diseases:—Fairly resistant to Bunt and Septoria. Moderately susceptible to Rust. Resistant to Flag Smut.

An early variety that showed promise under Test Row conditions and yielded well for both hay and grain, but shed badly.

M. 25 (*Nabawa x Carrabin*).

Type:—White, tapering bald ear. Medium straw that stands fairly well. Fair hay qualities. Sheds a little. Unattractive grain sample.

Diseases:—Fairly resistant to Bunt, Septoria and Rust. Resistant to Flag Smut.

M. 26 (*Nabawa x Carrabin*).

Type:—White, tapering bald ear. Medium straw that stands fairly well. Good hay quality. Sheds very little. Attractive grain sample.

Diseases:—Fairly resistant to Bunt, Septoria and Rust. Resistant to Flag Smut.

M. 28 (*Dindiloa x Nabawa*).

Type:—White, tapering, tip-awned ear. Medium to stout straw that stands well. Good quality hay. Does not shed. Attractive grain sample. Hard to thresh.

Diseases:—Resistant to Bunt and Flag Smut. Slightly susceptible to Rust and Septoria.

M. 30 (*Dindiloa x Nabawa*).

Type:—White, tapering, tip-awned ear. Medium to stout straw that stands fairly well. Fairly good hay qualities. Does not shed. Fair grain sample. Hard to thresh.

Diseases:—Resistant to Bunt and Flag Smut. Slightly susceptible to Septoria and Rust.

M. 31 (*Gluyas Early x Nabawa*).

Type:—White, tapering tip-awned ear. Stout straw that stands fairly well. Fairly good hay qualities. Does not shed. Fairly good grain sample.

Diseases:—Susceptible to Bunt, Rust, Septoria and Flag Smut.

M. 33 (*Florence x Nabawa*).

Type:—White, tapering tip-awned ear. Medium straw that stands fairly well. Good hay qualities. Does not shed. Very attractive grain sample.

Diseases:—Fairly resistant to Bunt, Rust and Septoria. Resistant to Flag Smut.

OAT VARIETIES.

In order to obtain more information as to the possibilities of a few oat varieties, which, up to the present, have not been tested here under field conditions, it was decided to test them in a Junior Field Trial, as is done with wheat varieties

The trial was planted on 24th May under ideal seeding conditions.

All varieties except C87, C90, and C95 germinated well on 2nd June.

All seed was pickled with a 1-450 formalin solution and as a result no loose smut was found throughout the test.

The varieties C87, C90 and C95 will be discarded, as they are of too late a maturity to be of use in this district.

The relative yields of hay and grain are as follow:—

Reg. No. P.	Name of Variety or parent varieties of Cross-breds.	Grain.	Hay.
1189	Mulga	124	100
1716	Palestine	104	59
1494	Burt's Early	100	100
C72	Algerian *x* Sunrise	89	89
1740	Belar	89	101
1522	Guyra	85	107
C 71	Burt's Early *x* Gartons	84	95
1724	Un-named	80	99
C 95	Algerian x Ruakura	63	55
C 90	Ligowa *x* Sunrise	55	40
C 87	Lachlan *x* Sunrise	47	38

Brief Notes on Characteristics of each variety.

C 87—*Lachlan x Sunrise.*—All late and useless varieties, not worth continuing with, as they as they have no value for hay, grain or early grazing.

C 89—*Ligowa x Sunrise.*—All late and useless varieties, not worth continuing with, as they as they have no value for hay, grain or early grazing.

C 90—*Algerian x Ruakura.*—All late and useless varieties, not worth continuing with, as they have no value for hay, grain or early grazing.

C 71—*Burt's Early x Garton's.*—Matures slightly later than Burt's Early. Useful variety for silage purposes, being tall and succulent. Stands fairly well; gives a good yield of grain, slightly plumper than Burt's Early. Sheds a little, and is susceptible to rust.

C 72—*Algerian x Sunrise.*—Very similar in growth to C 71. Yielded slightly better for grain. Stands fairly well; grain resembles Algerian in colour, but slightly shorter; susceptible to rust.

Belar—P. 1740.—This is a new strain of Glen Innes No. 5—P 1412—received from Cowra, New South Wales. Tall growing variety with fairly coarse straw. Hay not of good quality, but yields a good sample of grain, which threshes out well. Inclined to lodge in field trial this season; moderately susceptible to rust.

Guyra— P. 1522.—A tall growing grain oat. Rather coarse straw, which is inclined to lodge. Slightly later than Burt's Early. Inclined to shed its grain a little. Fairly plump grains, that are hard to part at threshing time; susceptible to rust.

Mulga—P 1189.—A heavy yielder of grain; slightly earlier than Burt's Early, but not nearly so valuable here either for early grazing or for hay purposes. Nice plump grain; sheds very little; susceptible to rust.

Palestine—P. 1716.—A short-strawed variety from Werribee, Victoria, which somewhat resembles Calcutta P. 469. Slightly earlier than Burt's Early. An excellent grain oat, but of no value for other purposes. Sheds its grain a little ; susceptible to rust.

Unnamed—P. 1724.—Received in 1925 for identification. Resembles Burt's Early a good deal, but has a slightly darker grain and is much weaker in the straw. Moderately susceptible to rust.

EXPERIMENTS FOR THE CONTROL OF EXANTHEMA IN JAPANESE PLUM TREES.

V. CAHILL, Orchard Supervisor.

As shown by Mr. W. M. Carne, late Botanist and Plant Pathologist to this Department, in an article in the issue of this Journal for March, 1926, Exanthema is a common disease of citrus in Western Australia. It occurs principally on light, gravelly soils with a stiff or gravelly subsoil, and is found more or less commonly throughout our orange-growing areas. Badly affected trees show typical die-back, and the fruit is discoloured or blotched with irregular brown markings of the skin which eventually becomes hard, dry and cracked.

Additional symptoms as described by Mr. Carne (loc. cit.) are as follow:—

1. The leaves on strong water shoots tend to become abnormally large and coarse, while the shoots have a tendency to droop outward and to grow upward at the end, forming an "S"-shaped curve.

2. Young shoots develop small blister-like swellings or gum-pockets, which if opened up will be found to contain a clear gum. Later, these gum-pockets develop into longitudinal ruptures edged with rough brown ridges, from within which gum exudes during wet weather.

3. Affected shoots tend to drop their leaves and to die back. The growth of laterals from the bases of the dead twigs produces a typically bunchy habit which is increased by the fact that growth-buds on affected trees frequently develop in clusters instead of twos, so that bunches of weak shoots subsequently arise.

A somewhat similar disease also identified by the Plant Pathologist's Branch as a form of Exanthema or Die-back has been found to be fairly common in the Darling Ranges on certain varieties of the Japanese Plum ("Satsuma" and "Santa Rosa"). It is largely confined to trees growing on gravelly soil with a stiff subsoil, and seems to be most frequent where the drainage is unsatisfactory. Trees growing on certain other soils are, however, subject to the disease to some extent.

In severe cases the pathological condition affects the terminal and sub-terminal branches as well as the trunk and larger limbs. Scaly bark appears on the young growth while the bark and wood of the older limbs are more severely affected. Splitting and scaling is the first sign and as the trouble increases the branches become much disfigured with dark, gummy, elongated fissures of the bark. These commence as longitudinal cracks which extend to the cambium layer. Later gum exudes from the ruptured tissues giving rise to a dark, rough, irregular, reddish-brown surface. Marked dying-back of the leaders on one side, or all around the tree is usually a very conspicuous feature of the disease. Although the cause of the trouble is not definitely known, it may possibly be that deficiency of organic matter in the soil is a contributing factor, as the soils where the condition occurs are very obviously deficient in humus.

Efforts made by the writer to work buds from an affected tree on to a healthy one, or to produce the disease by inoculation of sap or gum into the bark gave negative results. The buds did not take, presumably on account of their reduced vitality.

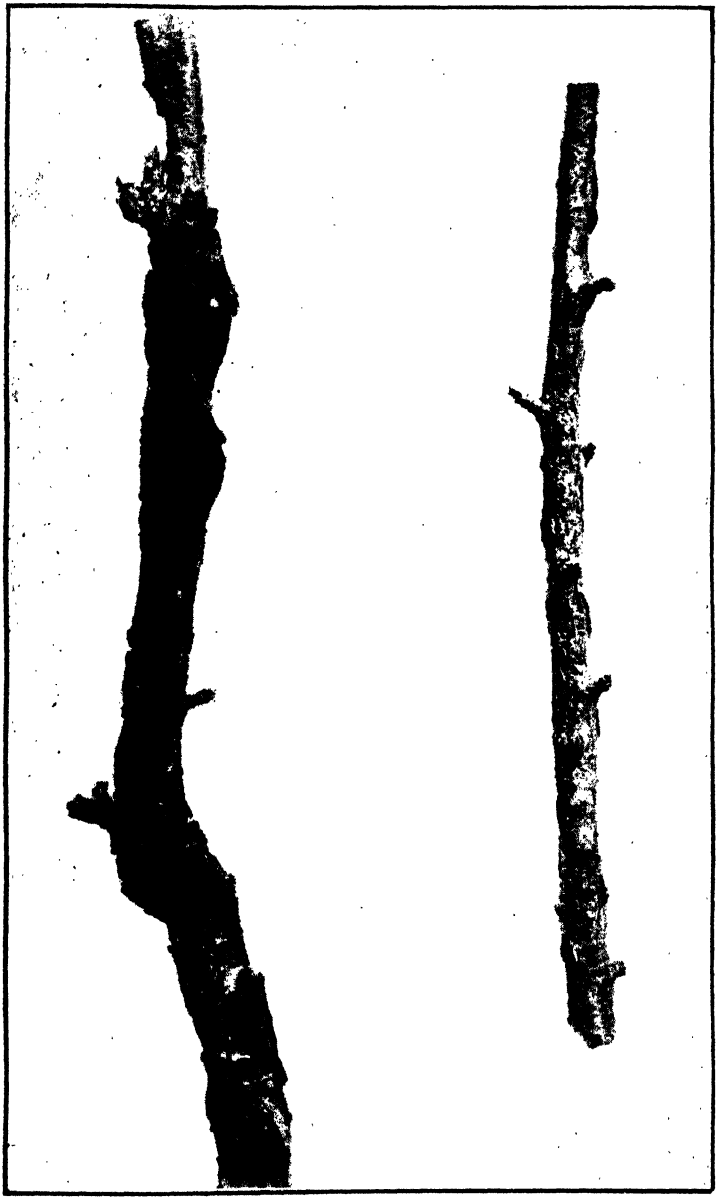

Fig. 1.

Exanthema on "Santa Rosa" plum showing bark eruptions.
Left: 3 years old. Right: 2 years old.

As the application of bluestone to the soil in the case of Citrus Exanthema had been found by Mr. Geo. W. Wickens, Superintendent of Horticulture, (1) to have a remedial effect it was decided to treat the plum trees in a similar manner, and during the winter of 1924 a number of "Santa Rosa" plum trees in the orchard of Messrs. Daniell Bros., Sawyer's Val-

Fig. 2.

Four-year old wood of "Santa Rosa" plum showing bark eruptions caused by Exanthema.

ley, were treated with an application of bluestone at the rate of 2½ lbs. per tree. The crushed crystals were spread on the ground beneath the trees and then worked into the soil. During the 1924-25 season the treated trees developed a good normal growth of stems and foliage, which has con-

Fig. 3.
Ten year old "Santa Rosa" plum trees badly affected with Exanthema.

Fig. 4.

'Shiro" plum tree very badly affected with a type of Exanthema.

tinued for the last four years. All the remaining trees in the same orchard with the exception of twelve, were sprayed with Bordeaux Mixture 6-4-40 just before the bursting of flower- and leaf-buds, and again in the early Spring of both 1925 and 1926, after the fruit had set, with Bordeaux 4-4-40. This has proved to be an effective preventive. Fifty per cent. of the untreated trees developed the disease, but the treated ones remained quite healthy.

SUMMARY.

1. A form of the disease known on oranges and other citrus species, as Exanthema, also affects various varieties of Japanese Plum.

2. The disease can be identified by the occurrence of die-back, and the presence of hard, rough, irregular fissures in the bark, often more or less covered with a dirty reddish-brown gum.

Fig. 5.
Twelve year old "Santa Rosa" plum tree severely injured by Exanthema.

3. Gravelly soils over a stiff impermeable subsoil, and otherwise poorly drained soils are favourable for the development of the disease.

4. The cause of Exanthema is not definitely known, but the disease can be prevented by spraying with Bordeaux Mixture, or controlled, when once it has appeared, by the application of crushed bluestone to the soil at the rate of about $2\frac{1}{2}$ lbs. per tree during the winter. This experience coincides with that of Smith and Thomas with Exanthema on stone, pome and other fruits in California (2) and McLeery (3) with various kinds of citrus in New South Wales.

Fig. 6.
"Santa Rosa" plum tree which has recovered after treatment with bluestone.

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(1). Wickens, Geo. W., "Exanthema of Citrus Trees"—Report of Proceedings Imperial Botanical Conference, London, 1924, pp. 353—357.

(2). Smith, R. E., and Thomas, H. E.—"Copper Sulphate as a remedy for Exanthema on Prunes, Apples, Pears and Olives"—Phytopath. Vol. 18, pp. 449—454, 4 figs., 1928.

(3). McCleery, F. C.—"Exanthema of Citrus in New South Wales." Agric. Gaz. N.S.W. Vol. 40, pp. 397—406 and 523—533, 9 figs., 1929.

Fig. 7.

Tame magpie sitting on her nest in a young "Satsuma" plum tree in the orchard of Mrs. Davies, Sawyers' Valley.

THE NEED FOR LIME IN WESTERN AUSTRALIAN AGRICULTURE.

GEO. L. SUTTON, Director of Agriculture.

In the British Isles and in other countries with a wetter climate than obtains over the major portion of the agricultural areas of Western Australia there is a tendency for acidity to be promoted and for the soils to become sour. Under these conditions lime, because its principal use is to correct acidity, does play a very much more important part in British agriculture than in our agricultural areas, where, on account of the dry climate, there is a tendency for the soils to become alkaline rather than acid.

Though this is the case generally the Departmental Officers are not unmindful of the possible useful effect that lime may have on special areas, or on individual farms, and, in consequence, Departmental action is taken to determine on what soils, and under what conditions lime can be used to advantage. Since the appointment of the Plant Nutrition Officer (Dr. L. J. H. Teakle) this work is under his guidance, and he is conducting examinations of our soils with the object of classifying them into district types, and quite recently has found a soil in the Pingelly district which is so acid as to require a heavy dressing of lime to improve its fertility. Other cases have also been found in the potato districts indicating the possibility of an application of lime proving advantageous, and already arrangements are in hand to conduct experiments during the coming season to determine this matter.

It is known that in the Beverley district the question of the application of lime to the soil is one of special interest, and because of this, experiments were commenced at the Avondale Farm as soon as possible after taking it over. The results of the two years' trials show that the application of lime has not increased the yield. The wheat crops were sown in the usual way in May with 45 lbs. of seed and 100 lbs. of superphosphate. The percentage yields are as follow:—

—	1928.	Average 1927–28.
Lime 10cwt. per acre...	99	95
No lime	100	100

At the request of a settler in the Tambellup district who was interested in this matter an experiment was carried out last year on his own farm, using in this case small quantities of lime and, of course, the usual application of superphosphate, 112 lbs. per acre. The results are as follow: Variety "Yandilla King." Rate of seed 45 lbs. per acre. Rate of superphosphate 112 lbs. per acre. Planted 30th April, 1929.

Plot No.	Applications of Lime per acre.	Computed Yield per acre. bus.	lbs.
1	No lime	15	21
2	1½ cwt.	16	6
3	3 cwt.	17	47
4	No lime	21	6
5	1½ cwt.	22	13
6	3 cwt.	18	37
7	No lime	14	45

The question of the need of the soil for lime is also associated with the desirability of remedying any phosphorus deficiency with some form of basic phosphate. Experiments to determine this point have been carried out at the Avondale Farm using basic slag as the basic phosphate. These results are unfavourable to the basic form, thus affording further indication that the soils did not need lime. The average results for the last three years are:

Superphosphate	75 lbs.	18 Bus. 15 lbs.	100%
Basic Slag	97 lbs.	15 Bus. 3 lbs.	83%
Basic Slag	75 lbs.	14 Bus. 43 lbs.	81%

The same experiment carried out as a Farmers' Trial at Wagin last year gave similar results—

Superphosphate	75 lbs.	31 Bus. 30 lbs.	100%
Basic Slag	97 lbs.	29 Bus. 17 lbs.	93%
Basic Slag	75 lbs.	22 Bus. 30 lbs.	72%

In the Clover Belt, owing to the wetter climatic conditions, and consequent more acid condition of the soil, it was anticipated there would be a distinct need for lime or for basic phosphate. So far this has not proved to be generally the case. Two liming experiments conducted by the Dairy Branch on some low lying flats in the Denmark district showed only an initial temporary benefit for the first few months from the application of lime.

Because Thomas' Phosphate or basic slag is alkaline, and like lime helps to correct soil acidity, it was considered probable that this fertiliser would prove a more suitable source of phosphoric acid than superphosphate but contrary to expectations the results obtained from applications of basic slag did not prove superior to those obtained from the use of superphosphate. The results of the top-dressing experiments on Group Settlements in 1926 are as follows. The results obtained on the location of F. Hobbs in 1927 are also included—

—		Super.		Basic Slag.		Basic Super.	
1926—Locations of—		tons.	%	tons.	%	tons.	%
— Burgoyne, Denmark ...	(Hay)	1·14	100	1·00	93	·98	86
A. McPherson, Peel Estate ...	(Green)	9·43	100	7·06	75	7·70	82
F. Hobbs. Manjimup	(Green)	6·93	100	6·75	97	6·30	91
1927—Locations of—							
F. Hobbs, Manjimup	(Green)	6·81	100	5·37	79	5·43	80

It is believed that the need for lime is rather local than general, and seeing that the lime content of our pastures is an excellent indicator in this connection, this view is supported by the results of an investigation into West Australian pastures by our Agricultural Adviser Underwood, who, in summing up states—"The lime content is high in all types of pastures sampled, except D1 and to a lesser extent F4. These are from untreated White-gum soils commonly reputed to be deficient in lime"; and "The energy values are rather lower and the fibre and lime contents higher than the British figures, but the outstanding differences lie in the phosphoric acid and protein percentages."

In connection with the relation between the lime content of soils and the application of superphosphate he also points out in the same thesis that Professor Perkins of South Australia obtained quite appreciable increases in the lime content of pastures from his plots top-dressed with superphosphate, whereas the pastures in the plots not top-dressed were very poorly supplied with lime.

Lime is also useful in controlling some, but not all, pests and diseases. Some diseases like "Finger and Toe" of the Turnip family find a condition of alkalinity unfavourable to their development, and, in consequence, an application of lime sufficiently heavy to correct acidity will prevent or inhibit them. The opposite position obtains with other diseases, as for instance, Potato Scab and Flag Smut, which are encouraged by a condition of alkalinity, such as is usually produced in dry climates, or by the application of lime.

The extent to which the quantity of Flag Smut is affected by the application of superphosphate and of lime has been brought out by investigations conducted at the Werribee Research Farm by Foster and Vasey. The results obtained in 1927-28 were—

THE RESULTS OF COUNTS MADE FOR FLAG SMUT INFECTION.

Manurial Treatment.	Percentage of Diseased Plants.	
	1927.	1928.
No manure	1·9	4·4
Superphosphate, 1cwt. average	1·8	3·8
Super. 1cwt. + Lime 20cwt.	13·2	11·3
Super. 1cwt. + Lime 10cwt.	13·4	14·4
Super. 1cwt. + Lime 5cwt.	7·6	10·9
Thomas' Phosphate 1cwt.	7·7	...

It will thus be seen that the effect of adding the usual light dressing of 10 cwt. lime per acre was to quadruple the extent of Flag Smut infection.

There are some farmers who believe that the continued application of superphosphate is likely to cause the soil to become more acidic as the result of the depletion of its lime contents. This phase of the lime question was discussed briefly in this Journal for June, 1928, and it was then pointed out that there was no foundation for such a belief—"Farmers in the Clover Belt and elsewhere may, therefore, continue using superphosphate without fear that their soils will become more acidic because of its continued use, and also with confidence that the calcium compounds in the superphosphate will furnish the calcium needed by the plant for a food."

POTATO DISEASES IN WESTERN AUSTRALIA.

(Continued.)

3.—IRISH OR LATE BLIGHT.*

(Caused by *Phytophthora infestans* (Mont.) de Bary.)

H. A. PITTMAN, B.Sc.(Agr.),
Plant Pathologist.

Although uncommon in Western Australia, "Irish Blight" is in many countries the most destructive disease of potatoes, as, in localities where warm, muggy conditions occur during the day and comparatively low temperatures at night, it may rapidly attain epidemic form, and, in the course of a few days, completely destroy the plants over large areas.

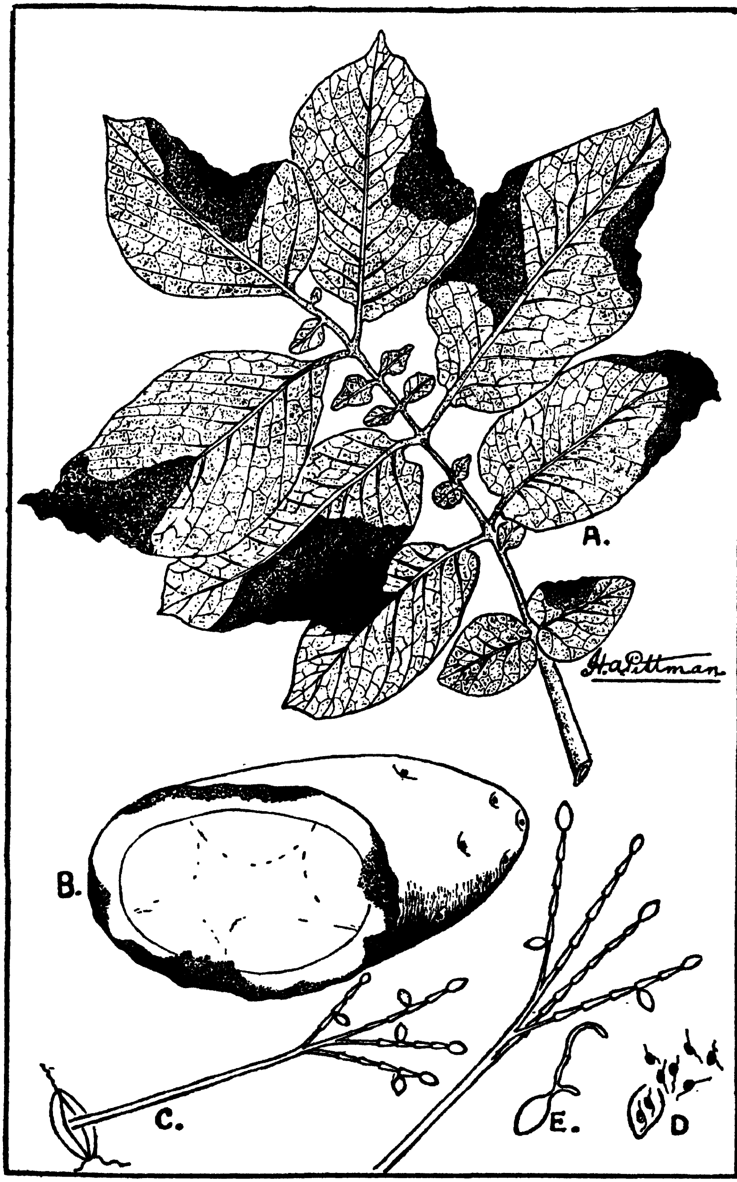
Phytophthora infestans, the fungus responsible for "Irish" or, as it is often called, "'Late' Blight," was apparently introduced almost simultaneously into Europe and North America between 1830 and 1840. By 1845 it had become widespread, and in that year it became so serious in Ireland that disastrous famines resulted from the wholesale destruction caused to the potato crops on which the poorer classes largely subsisted. Great numbers of people died of starvation, serious political disturbances ensued, and there commenced a great exodus of Irishmen from the Emerald Isle to the United States of America as a direct consequence of the resultant unhappy conditions.

Fortunately for the potato growers of Western Australia the climatic conditions here are only rarely such that "Irish Blight" need be feared. This is borne out by the fact that, although the disease is widely distributed in Western Australia, it has only been recorded by this Department on comparatively rare occasions during the twenty-one years since the disease was first officially recorded here (*i.e.*, in 1909). At no time during the history of this State does it appear to have assumed epidemic form. During September and October of 1928 the *Phytophthora* made its appearance at widely scattered points around the metropolitan and adjacent areas, but did comparatively little damage as the climatic complex necessary for its appearance in serious form was only intermittent in its occurrence, and soon passed away altogether.

SYMPTOMS.

Leaves, petioles, stems, blossom-stalks and tubers may be attacked. On the leaves, dead, brown or blackish more or less extensive, collapsed, water-soaked areas occur which usually commence near the margins of the leaves and rapidly work inwards. (See Fig. 1A.) If the weather conditions subsequently become hot and dry the dead areas may wither and dry up, but if humid conditions continue they may rapidly rot away with the evolution of a characteristic offensive odour. Infection usually first takes place on

* For diseases 1 and 2, Rhizoctonia Scab (due to *Rhizoctonia solani*), and Common Scab (due to *Actinomyces scabies*), see preceding issue of the "Journal" or Leaflet 79, second edition.



Explanation of Figures.

Fig. 1.—"Irish blight" of potatoes caused by *Phytophthora infestans.*
A, Potato leaf showing "Irish Blight."
B, Potato tuber showing the reddish-brown areas of dry-rot due to *Phytophthora infestans.*
C, Fruiting-branch of the fungus protruding from a breathing-pore in a potato leaf.
D, Formation of *zoospores* on germination of a *sporangium.*
E, Germination of spore under warm conditions by a germ-tube. (All parts of the fungus highly magnified.)

the lower leaves. In warm muggy weather the disease advances very rapidly, and the entire tops may soon become blackened and collapsed (see Fig. 3), followed by a wet rot involving the stems as well as the foliage. If affected leaves are examined after being placed in a moist jar overnight, or even after a cold night in the field, great quantities of delicate white mould may be found on the under surfaces and especially along the margins between the dead and healthy tissue. This is composed of the

Fig. 2.—"Irish Blight" on potato leaves.

spore-bearing bodies (*sporangiophores*) of the fungus which have grown out overnight through the *stomata* or breathing pores of the leaves. (See Fig. 1c.) The spores (*sporangia*) readily break away from the *sporangiophores,* and are carried in the dew or by wind or rain to the soil or neighbouring leaves or plants. On germination each *sporangium* produces a number of actively motile animal-like bodies called *zoospores,* which swim about in the moisture until in a favourable position to attack new areas.

(See Fig. 1D.) Each then settles down, forms a cell-wall about itself, and pushes out a thread or *hypha* which proceeds by growth to penetrate the host, and subsequently extend the disease.

Fig. 3.—Young potato plant affected with "Irish Blight."
After McAlpine.

Under high temperatures the *sporangium* may germinate directly by a germ-tube instead of forming *zoospores* (*i.e.*, it may function as a *conidium*. (See Fig. 1E.) The threads of the fungus grow about between the cells of the host and absorb food materials by means of absorbing structures, called *haustoria.* (See Fig. 4.) So great are the demands on the host that death of the cells rapidly follows.

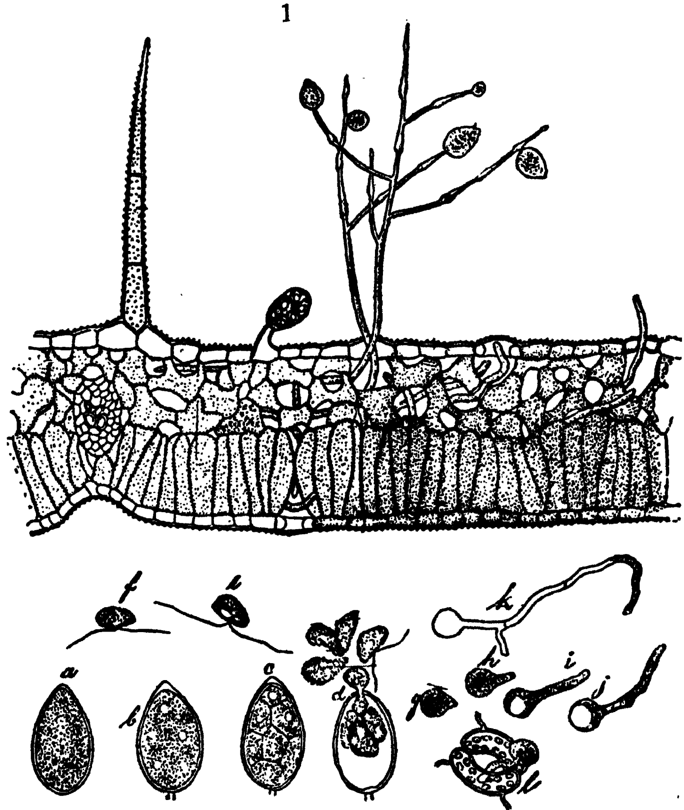


Fig. 4.—Section of potato leaf showing fungus within leaf and also method of production of fruiting bodies and *zoospores* by the fungus. *After Scribner.*

The disease may prove disastrous in two ways. Firstly, if attack comes early in the season the yield of tubers may be greatly reduced on account of the killing of the leaves and stems. Secondly, very serious loss may result from direct attack on the tubers themselves. *Sporangia* may be washed down into the soil by rains and dews, and on germination the *zoospores* may bring about direct infection of the tubers. A *dry or wet rot* may result according to the moisture and temperature conditions in the soil at the time. Where the soil is heavy, damp and warm, complete disintegration of the tubers may speedily result. Under conditions less favourable

to the organism, the disorganisation and characteristic reddish-brown discolouration of the tissues may only occur to a depth of about ⅛in. to ¼in. (See Fig. 1B.) In such cases the diseased tubers remain comparatively firm, but the surface may be slightly sunken and become somewhat purplish-black in colour. This *dry-rot* condition may be evident on digging or may only become clearly apparent after some time in storage. Cool, well aerated, dry storage conditions materially check the dry-rot symptoms from further development, but if the conditions are damp, complete destruction of the whole stack may speedily follow. This is, of course, largely assisted by secondary organisms, which follow up the initial injuries caused by the *Phytophthora.*

Fig. 5.—Showing effect of Bordeaux mixture in preventing attack by Irish Blight. Plants on left and right sprayed with Bordeaux; those in centre not sprayed.

After Duggar.

The diease appears to be carried over from year to year by means of fungus-threads, which hibernate within affected tubers. When such tubers are planted the threads of the fungus (*mycelium*) grow up the developing shoots and, under favourable conditions, produce the *sporangia,* thus starting the disease in the new season's foliage. If the mean day temperatures lie between about 70° and 74° F., the humidity is high, and the night temperatures fall to about 50° F. the blight may speedily attain epidemic form.

CONTROL OF IRISH OR LATE BLIGHT.

As stated above Irish or Late Blight has never yet become a serious trouble in our potato-growing areas. Many years may pass without any sign whatever of the disease being present. Nevertheless, should the climatic conditions ever become favourable for the disease for a week or so on end great damage might result. The growers should, therefore, be pre-

pared to take action against the parasite should it make its appearance during warm muggy weather.

1. *The disease can be readily controlled by spraying with Bordeaux mixture* 4-4-50 *or* 5-5-50. (See Fig. 5.) Affected plants cannot of course be cured, but still healthy plants can be protected from attack. Care should be taken to apply the spray with as much force as possible, and particularly to the bottom sides of the leaves. If commercial Bordeaux is used, 1lb. should be used to 5 gallons of water. As the disease is of such rare occurrence here, preventive spraying each year and several times during each season, as is necessary in many other countries, is not justified, but in view of the havoc which the disease may occasion at short notice, all growers should be prepared.

2. If the tops become badly attacked towards the close of the season and dry weather follows the tubers should not be harvested till a week or more after the tops are dead, as the risk of extensive infection of the tubers, with subsequent rotting in storage, is then considerably reduced owing to the killing of the *sporangia* by the dry weather. Where only small areas are affected the tops should be cut away and burnt before the tubers are harvested.

3. If the tubers must be harvested shortly after attack, cutting away and burning the tops, combined with spraying of the soil with Bordeaux 4-4-50 before digging, will considerably reduce the percentage of affected tubers.

4. Care should be taken to keep the plants well hilled up, so as to prevent the *sporangia* readily reaching the tubers.

5. After digging the potatoes should be kept in a cool dry place to reduce the rotting in storage to a minimum. Tubers stored at 40° F. or lower only rot very slowly, even if fairly badly attacked. **Never, on any account, place the leaves or stems of potato plants in the tops of the bags.**

6. Potatoes from a diseased crop should not be used for seed unless no others are available. In this case any showing brown discolouration on cutting should be culled out from the seed tubers and destroyed by boiling.

LOCUST WARNING.

L. J. NEWMAN,
Entomologist.

During the present season there has been evidence that this destructive pest is again on the increase. Given suitable climatic conditions, it is quite possible that in certain districts there will appear damaging swarms next August or September.

Farmers in the locust areas are, therefore, advised to take careful observation and note where the present minor swarms are depositing their eggs. Locusts lay their eggs in the ground. The favoured locations are bare, hard, non-grassy lands, such as roadsides, commonages and cleared uncultivated land.

If eggs are known to be present in such places, same should be ploughed and broken up, thus exposing them to the destructive effects of the elements, birds and predaceous insects.

Should any breeding grounds be missed, the young hoppers when found must be poisoned off before the winged stage is reached. For full details concerning the life history and treatment apply to the Department of Agriculture for Leaflet No. 142.

HORTICULTURAL NOTES.

GEO. W. WICKENS
(Superintendent of Horticulture.)

Up to the time of writing—26th of August—weather conditions in the fruitgrowing areas of this State have been most favourable for the development of fruit buds on deciduous trees. There has been ample rain, interpersed with fine, sunny days, and some frosts which were not sufficiently severe to cause damage, but temperatures were low enough to ensure the trees becoming thoroughly dormant in winter.

Weeds and clover crops came away early, and in well drained soils were ready to be ploughed under before the end of August. Some of the older settlers are prophesying an early spring, and whether this is merely a guess or an opinion based on meteorological prescience, no risks should be taken with the moisture present in the soil; cross ploughing should be completed by the middle of September and the ground around all trees hoed or forked, and then in October cultivators should be kept moving to minimise the growth of weeds and retain soil moisture to carry the trees along should dry weather be experienced in early summer.

Following on last year's exceptionally heavy crop of apples, the fruit buds on aged trees are not too promising, particularly "Dunns," "Rokewoods," and "Jonathans." "Cleopatras" and "Yates," however, are showing well for an average crop, and "Granny Smith" for a medium one.

The above refers to the older trees; the younger ones are carrying fine plump fruit buds and the crop on these will be good unless something unforeseen occurs during blossoming or setting. The trees, particularly the old ones, will be assisted in setting fruit if a dressing of nitrogenous manure, sulphate of ammonia or nitrate of soda at the rate of 3cwts. per acre is applied to the soil about two weeks before the trees blossom. Nitrophoska No. 1—a fertiliser comparatively new to fruitgrowers in this State—is also worth trying, as it contains 17.5 per cent. nitrogen in addition to potash and phosphoric acid in water soluble form.

Though in the above, apples only are mentioned, an application of nitrogenous fertiliser applied in spring, as advised in Horticultural Notes published in the March issue of the "Journal," is helpful to fruit setting, both on citrus and deciduous trees.

Citrus trees in nearly all districts commenced blooming very early this season, probably a result of a long, dry summer, followed by heavy rains in May and June. Orange aphis also made an early start and requires attention wherever the insects are sufficiently numerous to materially damage the blossoms. Last spring and early summer, Orange Aphis did a great deal of harm to the orange crop, more particularly in orchards in the coastal area, where in some instances the trees entirely failed to set fruit, as a result of the depredations of the pest. Black leaf 40 and soap is a standard control spray, and can be safely used on the trees at blossoming time, but "Volck"—another spray comparatively new in Western Australia—which was tested by the department last season, gives very good results, being deadly to the aphis and non-injurious to the trees, while it has an added advantage in the ease with which it can be mixed. Apply for Orange Aphis at a strength of 1 in 65.

In the test mentioned, "Volck" applied at a strength of 1 in 50 in the month of January, was very effective in killing red, black and soft brown scales on citrus trees.

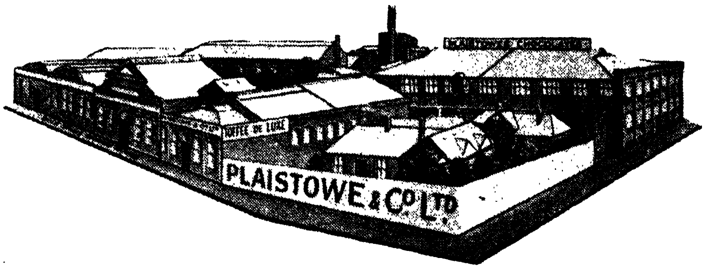
In the early part of last season Red Scale in citrus orchards got well ahead of the parasite, and in January and February it appeared that the fruit would be badly marked when ready for sale, but the experience of other seasons was again repeated, and before the oranges ripened the parasites had increased to such an extent, that scales both on fruit and trees had been reduced to negligible proportions. Western Australia is the only orange growing State in Australia where Red Scale is controlled by its natural parasite, and orchardists should take care to preserve the beneficial insect. There are undoubtedly seasons when the pest appears to have beaten this control, and be greatly in ascendancy, and at those times spraying or fumigation may be necessary, but should this occur, the artificial means of control should not be carried out through the entire orchard. Some infected trees should be left to carry on the parasites, for the experience gathered over a number of years shows that when we relied on sprays and fumigation to control Red Scale, the pest was much more in evidence than it is to-day.

During the months of October, November and December, fruit fly will become increasingly active as the weather becomes warmer, and the soft fruits ripen, and baiting, trapping, gathering fallen fruits, and destruction by boiling of all infected fruits is essential work that should not under any

circumstances be neglected. If all fruitgrowers, whether owners of broad acres, or occupiers of back yard gardens carried out this programme, as it should and could be carried out, fruit fly would soon cease to be a serious factor in the fruit industry of Western Australia. Instances can be quoted where baiting and destruction of infested fruit has held the pests under control, both when the baiting was done by a number of growers working together in a community effort, and also when the work was performed by individual growers. But the pest is virile and prolific, and no known method which assists in control should be neglected, so the advice is earnestly tendered to all growers in the infected portions of the State (fortunately, a large area still remains free) to bait once every seven days, to trap continuously, to gather fallen fruit daily and to boil all fruit found to be infected.

Red Mite (*Bryobia pratensis*), is another pest needing attention during the early summer months. In the past growers have depended mainly on oil sprays applied to the trees while dormant in winter, but though undoubtedly a great number of the eggs are destroyed in this way, there are always enough left to carry on the pest, and unless an early summer spraying is carried out when the mites become noticeable shortly after the fruit has set, they soon increase to such an extent that serious damage to the trees occurs.. "Volck" at a strength of 1 in 65 has proved very effective as a summer spray without injuring either fruit or foliage.

As a result of the campaign against Codlin Moth, the Collie outbreak has been entirely suppressed, and the Narrogin outbreak reduced to such an extent that only four larvae were found there during the whole of last season, But just as the pest found an entrance to the orchards in those centres, so it may at any time be introduced to other fruit growing districts, for it is prevalent in the Eastern States, and may be introduced in goods at any time. Every fruitgrower should take notice of any apple, pear or quince showing evidence of having been tunnelled by a caterpillar, and if he does not know the culprit, should at once communicate with the department. It is only this close co-operation of the growers with the department that has enabled steps to be taken which have resulted in Western Australian apple orchards being free from one of the worst pests of apple growers.



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POTATO CHIPS.

G. N. LOWE
(Senior Potato Inspector.)

Erratum.—Under the heading of "A probable cause of bad germination" in the June issue of this "Journal," the following appeared:—"Where no care had been exercised in placing the 'set' to see that the skin was not exposed to the fertiliser, the resulant damage was often so great as to practically wipe out the crop."

In place of "skin side," read "cut side," and the proper rendering is obtained. The context, however, showed the obvious mistake, but it is thought advisable that special attention should be called to it.

Certified Seed.

It is pleasing to be able to state that the record certification of seed has occurred in our Centenary Year, but it is confidently expected that this will be easily eclipsed next season from the indications at present.

Just over 5,000 bags have been sealed this season, with the demand for double the quantity unsatisfied. Just here, it is well to point out that growers who need supplies for next season, must be seized of the necessity of getting their orders in at least three months ahead of their expected planting period, to be at all sure of obtaining their requirements.

For the guidance of growers who plant in June and July in South-Western districts, it will be of use to know that the seed which is best suited to their planting is dug in the Albany-Denmark district in March and April.

In the case of growers situated at Osborne Park, Spearwood, Jandakot and Coogee, who do not plant until September and October (or growers similarly placed), seed dug in May and June from south-west swamps, or Albany-Denmark hills, is more desirable, being not too forward at planting.

With this knowledge, growers in the various districts should make the necessary provision for their seed supplies well ahead, in order to avoid disappointment. The Potato Branch is always glad to give the necessary information as to where reliable seed may be obtained.

A factor which was responsible in no small measure for a considerably greater quantity of certified seed not being put through the scheme this season, was the high prices ruling at the time of digging.

Some few growers, particularly those who needed "the root of all evil," urgently at the time, decided to sell in old bags at £1 or so above market rates at digging, after having had their crops inspected under the Certified Seed Scheme. They used the fact that their crops had, so far, passed inspection, as a reason for extracting the extra money from their customers, but without being put to any expense themselves for final certification.

Viewed from the writer's standpoint, this is distinctly "not cricket," and in future, steps will be taken to ensure that where an application is made for certification, the applicant must "carry on" until such time as the officers of the Potato Inspection Branch advise him that his crop for one reason or another is not desirable.

Already, instances have been noted where such men, who, last season sold certified seed of very high standard, had direct repeat orders for this year, but supplied uncertified seed, declaring it "just as good," but failed to observe the same standard, with the result that this Branch has had complaints—why it is hard to fathom. Whilst officers endeavour to do everything possible to ensure certified seed being as near perfect as possible, they cannot be held in any way responsible in cases of this kind.

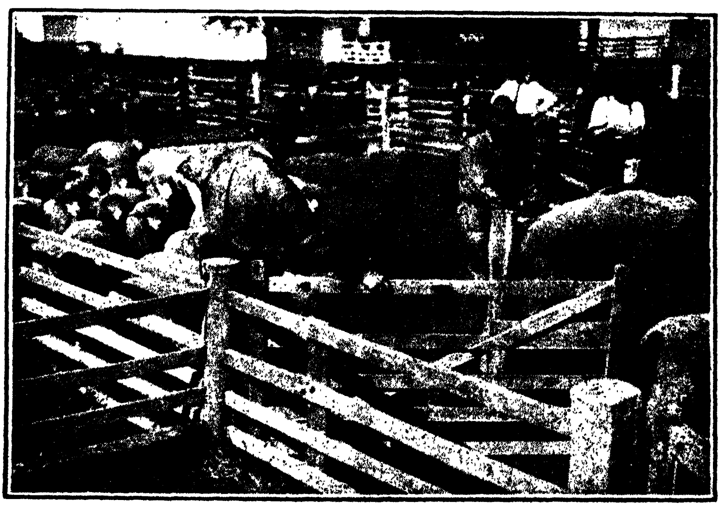
It does, however, demonstrate again—if demonstration be needed—the value of the certificate, and the Potato Branch may be forgiven if it harbours that un-Christian but perfectly natural spirit of "It serves you right." Moral—Insist on the certificate.

An instance of the extreme view on the other hand, is interesting. A Donnybrook grower obtained certification of sufficient of his own seed to plant his winter area, so that he might be able to state fairly that his crop was actually grown from certified seed, and a very excellent line the offering was.

The Way Potatoes Increase.

Last winter, Mr. "Bill" Fry, of Benger, who is a nephew of Sir James Mitchell, selected two extra large tubers from a bag of Certified Seed belonging to him and after cutting these into 42 sets, planted them under the usual conditions.

The return from these was 180lbs. of very fine potatoes. These were in January again planted in Benger Swamp, and yielded 13 bags, so that in two crops from two tubers nearly a ton of potatoes was obtained which once more emphasises the importance of "strain" in seed.



Counting the flock.

PHOSPHORUS, ITS HISTORY AND AGRICULTURAL IMPORTANCE.

B. L. Southern, A.A.C.I.

Phosphorus, the essential constituent of all phosphatic fertilisers, was first discovered by alchemist, Brand, of Hamburg, in 1669, but he kept his method of preparation secret. Robert Boyle, a celebrated English chemist and physicist, isolated the element in 1680. Until 1771 when Scheele prepared it from bones it was looked upon as a chemical curiosity.

In this, a popular science article, perhaps a glimpse into the complicated nature of our chief fertiliser will help the uninitiated to appreciate to a small degree, the recent investigations into the chemistry of what was once considered to be a simple compound.

Phosphorus occurs in nature, both in rocks and in bones, in the form of calcium fluophosphate and calcium hydroxyphosphate, represented by the chemical formulae $Ca_5F(PO_4)_3$ and $Ca_5(OH)(PO_4)_3$ respectively. These compounds have erroneously come to be referred to as tricalcium phosphate, a name dating back to the time when the presence of fluorine and hydroxyl (OH) in the natural compounds had not been recognised. The natural compounds contain the following elements:

	Fluophosphate.	Hydroxyphosphate.
Calcium, Ca	39.74%	39.90%
Fluorine, F	3.77	—
Hydrogen, H	—	.20
Oxygen, O	38.07	41.40
Phosphorus, P	18.42	18.50
	100.00	100.00

Freshly prepared phosphorus is a translucent, wax-like solid, which for safety sake must be kept under water; being very active chemically, it is eager to combine with other elements, particularly oxygen, so readily catches fire. For this reason it is never found uncombined in nature like some inactive metals such as native gold or silver. There are two varieties of phosphorus—the yellow which has been described above, and the red, which is made by heating the former out of contact with air. The red variety must be heated to a temperature of two and a half times that of boiling water before it catches fire. The yellow variety was once mixed with substances which readily gave up their oxygen and used for match heads, these matches would strike on any rough surface. The modern match head consists of materials rich in oxygen, which are ignited by rubbing on the safer red phosphorus on the sides of the boxes.

Yellow phosphorus is soluble in carbon bisulphide, and this solution, mixed with molasses, is used as a rabbit poison.

Phosphorus combines with oxygen forming, according to the conditions, phosphorus trioxide and phosphorus pentoxide (P_2O_5), the latter is of great importance in agriculture. Phosphorus pentoxide is commonly referred to

as "phosphoric acid," strictly speaking it is phosphoric oxide which is the anhydride of the commonest form of phosphoric acid. To make the acid, the solid white anhydride must be dissolved in water. The value of a phosphatic fertiliser depends on its "phosphoric oxide" content and not on its true phosphoric acid. In some countries the percentage of phosphate is given as "tri calcium phosphate," thus a manure containing 20 per cent. of P_2O_5 would be identical with one containing 43.7 per cent. of "$Ca_3(PO_4)_2$".

The value of a fertiliser to an agriculturist depends upon the solubility of the ingredients. The natural fluophosphate and hydroxyphosphate are very insoluble even when finely ground, so are not readily available to the growing plant. Many years ago experimentalists found that bones, which are more soluble than rock phosphate, improved crops, but in those days no one realised that a plant required phosphorus for successful growth. For a long time people argued that only water was required, and the plant got nothing from the soil. Others said plants used up the organic material in the soil, while some believed solid particles of soil

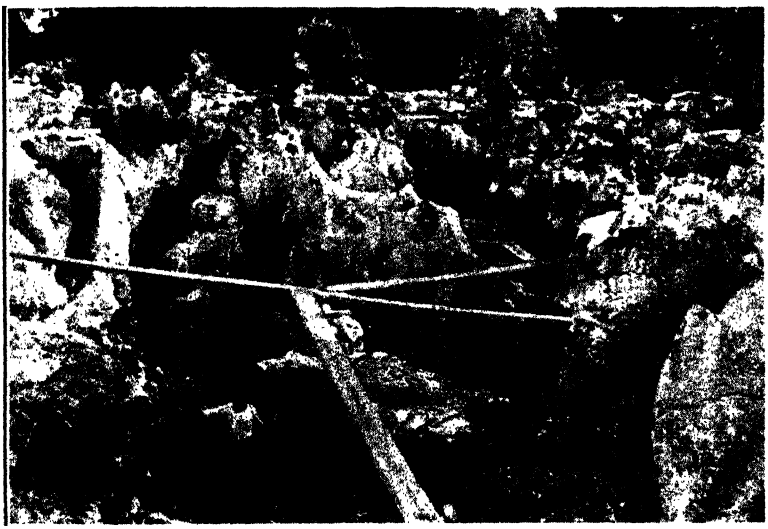
Phosphate and Coral, Ocean Island.
(Photo. by F. W. Steel.)

were absorbed by the plant, therefore the more the soil was broken up by cultivation the better it was for crops. Years later it was shown by cultures what elements, besides water and carbon dioxide from the air, were really essential for successful plant growth—among these elements was phosphorus.

It was known for a long time that bones contained phosphorus so a keen demand for bones was set up. About 1850 Liebig, a German chemist who emphasised several important theories in agricultural chemistry, some

not altogether correct, first published a method for making bones more soluble by treating them with sulphuric acid. Later, owing to the scarcity of bones, Lawes and Gilbert working at Rothamsted made superphosphate, for which they replaced the bones by rock phosphate. Liebig himself made the first artificial fertiliser by heating together potash, phosphates and lime, it was a failure however for the phosphate was rendered insoluble. He made a mistake in assuming that plants obtained their nitrogen from the ammonia of the air, so omitted to add it to his fertiliser. Insufficient knowledge of plant nutrition led him to believe that plant foods should not be easily soluble in the soil, else they would all be washed out in the drainage waters.

The important phosphates of calcium from the agricultural standpoint are the natural compounds previously mentioned which are very insoluble, the di-calcium phosphate which is soluble in very weak acid and solutions



Worked out phosphate deposit. Note coral mounds exposed.

of some complex substances in water, and the mono calcium or superphosphate which is easily soluble in water. On mixing the fluophosphate and hydroxyphosphate with the mono phosphate the di compound is readily formed if the water content of the mixture is high.

Some soils which contain much iron and only a little lime will not respond to superphosphate because the iron readily combines with the phosphate forming very insoluble iron phosphate, on such soils basic superphosphate—a mixture of super and lime—should be used, or what is known as basic slag. Where it is possible to apply lime economically this may be used followed by superphosphates.

By far the greatest quantity of phosphate used in Australia is obtained from islands scattered for the most part in tropical seas. It is the remains

of bird life accumulated over hundreds of years. Most of the islands are coral, and the phosphate is dug out by hand from between the masses. The phosphate rock is transported to the chemical works, where it is ground and mixed with proportions of sulphuric acid according to the purity of the original rock. The sloppy mixture of rock and acid is allowed to react in special bins. When the reaction is completed the product is dry, containing only a small percentage of moisture. Superphosphate is a mixture of monocalcium phosphate, gypsum and about one per cent. of the original phosphate rock, the removal of the gypsum is expensive, so it is allowed to remain.

Australian soils generally speaking are deficient in phosphate, while nitrogen and potash are fairly plentiful; the result is a great demand has been set up for phosphates. In 1906 West Australia used 8,600 tons of super and the amount increased to over 200,000 tons last year.

Phosphates increase the root development of plants thus giving them a greater feeding area resulting in better stooling of cereals and an increase in grain yield.

THE COMMON BLUE LUPIN.

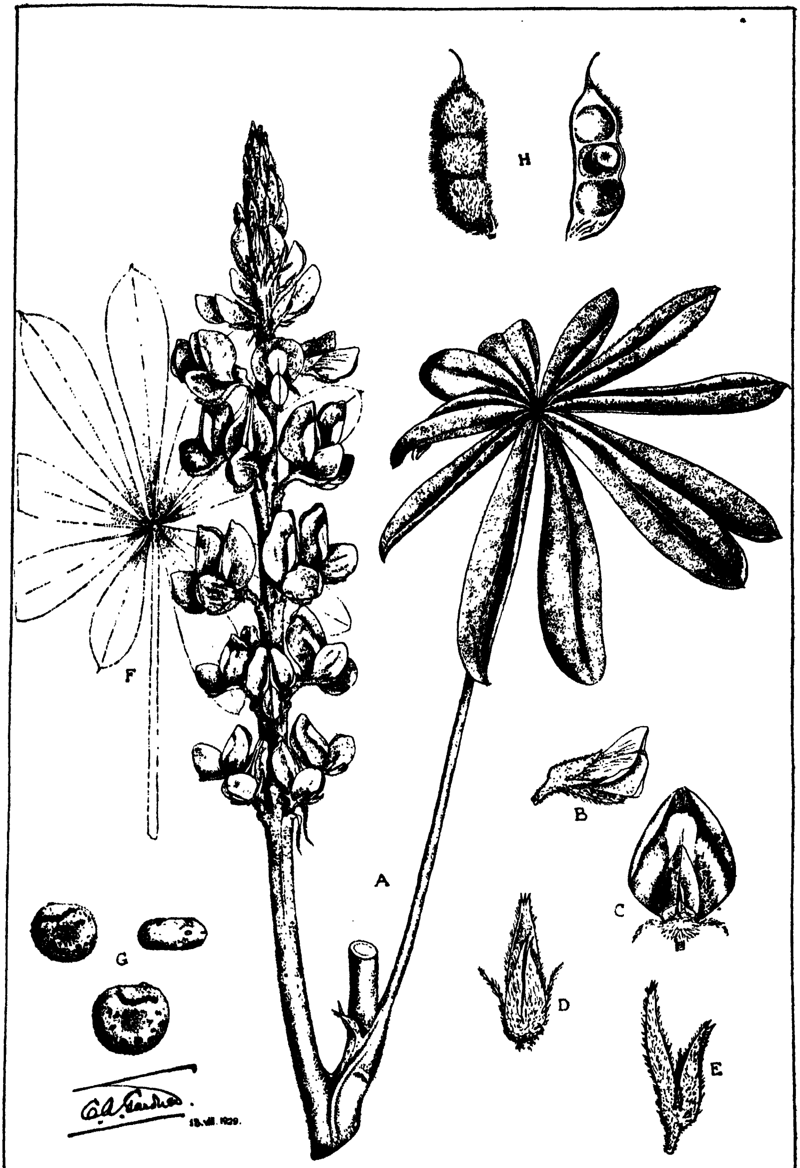
(*Lupinus pilosus.*)

C. A. GARDNER and H. G. ELLIOTT.

It is only during recent years that lupins have established themselves as naturalised aliens in Western Australia. There is little doubt that they were originally introduced as ornamental plants, for many of the species are of horticultural value. Escaping from gardens they have acclimatised themselves and the first record we have of their occurrence as naturalised plants is from the vicinity of Cannington. The Woodlupine Brook and locality appear to have been named about the year 1903 from the prevalence of lupins there.

For many years the localised lupins were regarded as noxious weeds, which in spite of discouragement spread over wide areas, principally in the Victoria, Midlands, and Metropolitan districts, favouring the lighter types of soil, and making the most progress in the Jam country of the Northampton district, where they now cover large paddocks and line the roadsides for many miles. In time it was found that the seeds were relished by sheep, and provided fattening food in the summer months when feed was scarce, hence the outlook regarding lupins soon completely changed, and they came to be regarded as useful forage plants suitable to the lighter types of soil. Now the cultivation of these plants is encouraged, and lupin paddocks are considered to be valuable assets to the farmer in fattening sheep during the dry period of the year.

Much prominence has been given to lupins by the recent inauguration of a "Lupin Competition" by the "West Australian Newspapers, Ltd.," of Perth. This movement has stimulated farmers to cultivate lupins on a larger scale, and has been responsible for the introduction of lupins into



Explanation of Plate.

Plate 1.—a, Flowering receme and leaf, half natural size; b, Flower, half natural size; c, Flower, about three-quarters natural size; d and e, Calyx (d, view from below; e, side view) 1½ times natural size; f, Leaf, half natural size; g, Seeds, natural size; h, Seed pod, half natural size.

areas where they were not previously grown. The demand for seed has consequently been large, exhausting the supply of local seed at an early stage, and to meet the growing demand, large importations of seed of "Blue Lupins" have been recently made from New Zealand.

Concerning the species of lupins naturalised in Western Australia, our knowledge at the present time is meagre. *Lupinus pilosus* appears to be the most common species, and is the one described here; *L. hirsutus* occurs also, and may be the common blue lupin of the northern districts. A third blue-flowered species is *L. angustifolius* which is relatively unimportant and is found around Perth and Midland Junction, extending perhaps northwards as far as Gingin. A fourth species is a yellow-flowered lupin naturalised near Welshpool and Armadale. This may be the common yellow lupin (*L. luteus*) which has been responsible for heavy mortality amongst stock in other countries.

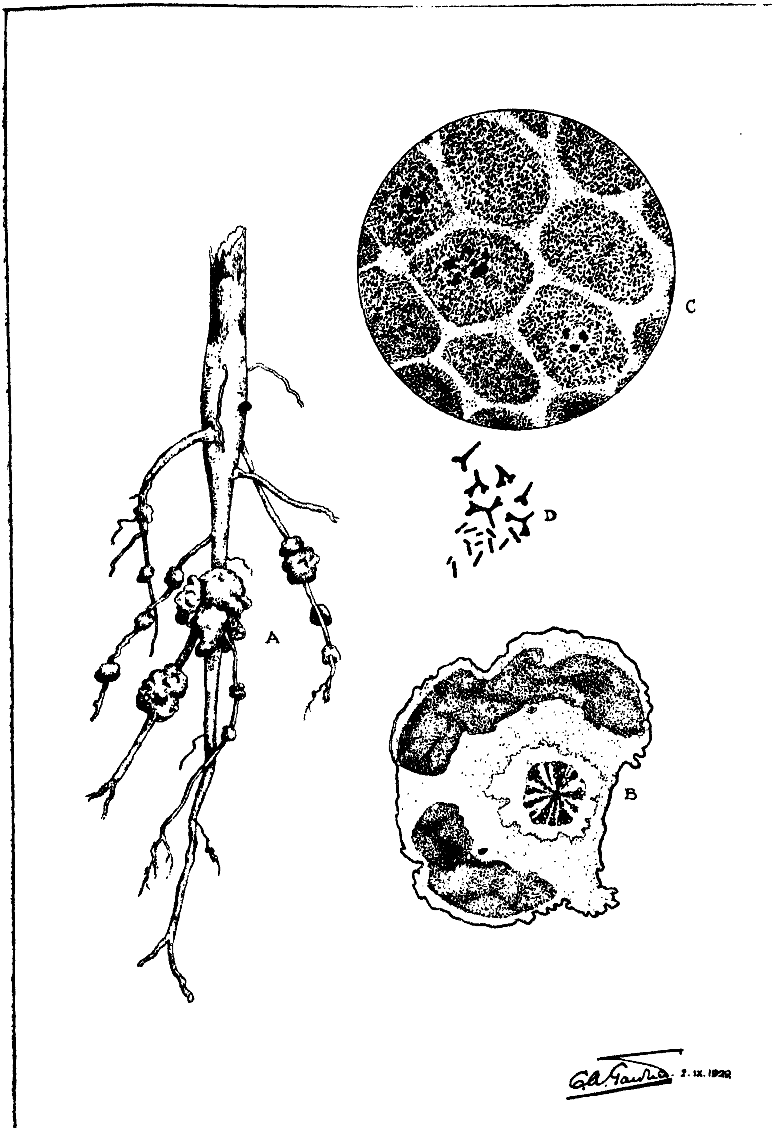
The species imported from New Zealand is *L. angustifolius* which is a form of the least important of the locally naturalised blue lupins. It has larger seeds than the local form of this species.

The lupin presumed to be the common blue lupin is *Lupinus pilosus.*

Description of Plant.—An annual or rarely biennial herbaceous plant attaining a height of four to five feet, though usually about three feet high. Leaves consisting of 9 to 13 leaflets radiating from the summit of a long petiole or leafstalk. The leaflets are oblanceolate in outline, concave or folded, two to three inches long and half to three quarters of an inch in width at the widest part, villous with fine close hairs on both surfaces; stipules small, linear, attached to the base of the leaf-stalk. Flowers in terminal racemes, the flowers of the top raceme opening first from below upwards, azure blue, all whorled; bracts lanceolate, falling early; bracteoles linear, attached to the calxy-tube. Calyx with two divergent lips, the upper one two-partite behind the standard, the lower (below the keel) longer, usually very shortly three-toothed, or occasionally 2-toothed; standard erect with reflexed edges, with a white blotch in the middle; wings much smaller; keel enclosed in the wings, incurved; stamens with united filaments; style incurved. Pod 1½-2 inches long, flattened, with 3-4 large seeds, constricted between the seeds, hairy outside, the persistent style forming a slender beak Seeds large, compressed, slightly roughened, pale grey-brown with dark mottling, about 3/8in. in diameter.

The name *Lupinus* is taken from the latin *Lupus* a wolf, from some fancied ability of the plants to prey upon the soil. There are upwards of three hundred species, a few of them being useful as soil renovators (especially *L. luteus*), for fodder, and for human food. There are two cultural groups, the large seeded agricultural species, and the ornamental species.

The common blue lupin is naturalised between the Murchison River and Busselton, particularly in the northern areas of this range, especially favouring the lighter soils. We do not yet know which species are most common in the different districts, but *L. pilosus* certainly has the widest range. Lupins are now being grown throughout the greatest part of the agricultural areas between the Murchison River and Esperance, although much of the seed planted consists of *L. angustifolius* imported from New Zealand, and it should be remembered that this species has not yet proved itself as a forage plant. It has been claimed that this latter species will



Explanation of Plate.

Plate 2.—a, Root system showing bacterial nodules (half natural size); b, Section through nodule (much enlarged), showing the zones comprising bacterial colonies above and below the root; c, Lupin nitrogen-fixing bacteria in the plant cells; d, The bacteria; Branching and rod forms of bacteria; (c, taken from G. T. Moore, from Harshberger, Mycology and Plant Pathology).

stand frost better than the naturalised species, but this is very doubtful, at least in some areas. This so-called "New Zealand Blue Lupin" is grown in New Zealand as a green manure crop, and not as a fodder plant. Unless it flourishes to an unexpected extent in Western Australia, it will be found to be much inferior to the local species because of its reduced size, smaller seeds, and its high capacity for germination—which may be a disadvantage when early rains occur followed by a dry period. This would necessitate reseeding the area.

Lupins in Europe and America are not regarded as fodder plants. On the other hand they are described as poison plants, and *Lupinosis* or lupin poisoning has caused them to be gazetted as poison plants in Canada and some States of the United States of America. As green manuring plants they are extensively grown in Europe, especially in Germany where *L. luteus* is the principal species under cultivation.

In Western Australia the naturalised blue lupins have proved to be of inestimable value to the pastoralist, particularly the sheep farmer. Stock should not be permitted access to lupins during the young stages of growth since grazing is fatal to the young plants. If there is abundance of other green feed, stock will not eat the lupin in a green condition. In the summer when the seeds have fallen, it is estimated that a lupin paddock will carry up to four sheep per acre and fatten them.

The Lupin is a hardy vigorous legume. Leguminous plants are well known for their value as food, forage plants and soil renovators. All leguminous plants possess the capability of obtaining nitrogen from the atmosphere. This is effected by nitrogen-fixing bacteria which are present in nodules upon the roots of these plants. These nodules are wart-like protuberances or outgrowths of the roots and are visible to the naked eye. They may be smooth, wrinkled, spherical, or of irregular shape, and may occur singly or in clusters at the side of, or surrounding the root. In the young stages they may be white, pink, yellow, or pinkish-brown, delicate in texture and mostly filled with nitrogen-fixing bacteria and nutrient plant-juices. They may be easily separated from the root since the connecting tissue is somewhat fragile. If these nodules are not present on lupin plants, the lupins cannot obtain nitrogen from the air, and since leguminous plants in general require more nitrogen than other plants, the absence of these nodules from lupins renders them soil impoverishers instead of soil builders. In soil poor in nitrogen, the lupin without nodules grows poorly or not at all.

In places where the lupin succeeds, the soil is said to be inoculated, *i.e.*, there are present in the soil the nodule-forming bacteria. These bacteria can be carried on the seed, and when planted with the seed they multiply rapidly, but their spread in the soil is slow. The bacteria which inoculate the lupin do not affect any other leguminous plant except Serradella (*Ornithopus sativus*) which is not grown in Western Australia. It is therefore incorrect to assume that where other legumes grow successfully and possess bacterial nodules, the lupin will be inoculated from them.

If one of the lupin nodules is sectioned transversely and examined with a high powered microscope the bacteria will be seen as numerous minute rod-like or Y-shaped bodies occupying definite zones in the tissue. These zones are indicated by the darkly shaded areas on the accompanying plate. The bacteria enter through the roots or the fine root hairs. The stimulation of the root-cells causes the formation of the nodules. In the nodules the bacteria

multiply rapidly, obtaining their food from the plant juices, and in return contribute a continuous supply of nitrogen to the plant in a form which is available as food. This nitrogen is obtained by the bacteria from the air present in the soil. The supply of nitrogen in the nodule is greatest when the plant commences to flower; from then onwards there is a reduction until the seed is fully ripe. The nodule ceases to develop when the seeds commence to form. They then lose their plump appearance, shrink and eventually decay. The bacteria return to the soil remaining there until they regain contact with roots the following season.

Natural inoculation, depending as it does, upon the introduction of seeds carrying the bacteria, wind or water, is slow and unsatisfactory. Artificial inoculation by soil infection is obtained by transferring soil from places where the lupin bacteria are known to be present, to the new land, but a preferable method is the introduction of pure bacteria in culture. This should be done in cool weather.

Not only is the lupin valuable as a fodder plant, but also as a soil renovator and fertiliser. Lupins succeed best in light sandy soils, provided the bacteria are present. Turned under as a green manure the lupin will contribute large amounts of the otherwise expensive fertiliser nitrogen, and in a form quickly available as plant food.

Since the lupin develops its seeds irregularly, and when ripe, they are instantly shed, hand harvesting is the best method for the farmer. Mechanical harvesting is the only practicable means over large areas, but the percentage harvested is less than in the case of hand picking.

Descriptions of Seeds.

1. Common Blue Lupin (*L. pilosus*).

Seeds roundish and flattened, the flattened sides being slightly concave; three-tenths to four-tenths of an inch in diameter, by one-eighth of an inch in thickness; round and dull (not shining) the roughness being due to minute warts or protuberances on the surfaces. The colour is greyish-brown with dark brown spots or streaks, giving the seed a more or less speckled appearance. Germination poor, ranging from 10-50 per cent. This low germination is due not to dead seeds, but to the high percentage of hard seeds which do not germinate readily (many remaining dormant in the soil for one or more years), and is to be regarded as an advantage in established areas, since the germination resulting from inadequate early rains from which the plants will not survive, will not materially affect the ultimate crop. It is however, a disadvantage when endeavouring to establish a good stand during the first season.

2. Hairy Lupin (*L. hirsutus*).

This appears to be the other valuable naturalised lupin. The seeds are not available to us for description, but they are said to differ from those of *L. pilosus* in being smooth and the mottling more pronounced.

3. Narrow-leaved Blue Lupin (*L. angustifolius*).

   a. ***Western Australian Seed***: These seeds differ in shape and size from those of *L. hirsutus* and *L. pilosus*. They are not flattened but more or less egg-shaped or almost spherical, three-

tenths of an inch and under in length, by one-fifth of an inch across. They are smooth and shining, slate-grey in colour with chocolate-brown streaks and lighter grey spots, giving a decidedly speckled appearance to the seed. The germination is slightly higher than that of the Common Blue Lupin, and there is always a percentage of hard seeds.

b. *New Zealand Seed*: These are of the same shape as the local seeds, but they are much larger, being over three-tenths of an inch in length by a quarter of an inch in diameter. The speckled appearance in general is not so pronounced, the slate-grey colour being more predominant, and the chocolate-brown streaks are not so distinct. The germination is high (up to 100 per cent.). This is not to be regarded as an advantage, since unseasonal rains may cause the total germination of the seeds in the soil, and re-seeding will be necessary when the normal season commences.

4. Yellow Lupin (*L. luteus*).

It is supposed that this is the yellow lupin naturalised along the South-Western railway. The seeds of this species are the largest of those described here; they are dull light grey or almost white, with pale brown markings.

Lupins grown near Esperance.

THE INOCULATION OF LUPINS AT THE MERREDIN EXPERIMENT FARM.

L. J. H. TEAKLE and E. J. LIMBOURN.

The lupin is a member of the order known as *Leguminosae,* which includes, in addition, such plants as clovers, lucerne, trefoil, peas, beans, acacias and a host of others. It was very early noticed that the legumes usually had tubercles or nodules on their roots and that, when affected by these nodules, they could grow on poor sandy soils and improve its fertility for other types of plants. Two German chemists, Hellriegel and Wilfarth, in 1888 found that leguminous plants, when infected with nodules, were able to absorb their supplies of nitrogen from the air and thus grow vigorously on poor, nitrogen-deficient soils. Other plants, and also legumes with no nodules on their roots, were unable to make use of the nitrogen of the air, and consequently starved on these soils.

The same year, 1888, Beijerinck, a clever Dutch bacteriologist, isolated the bacteria which caused the formation of the nodules on the roots of leguminous plants. It was later proved that these bacteria actually "fix" the nitrogen of the air in such a form that it is available for the use the host plant. It has also been found that these bacteria live in the soil and infect the roots of their respective legumes in a similar manner to those organisms which cause root diseases. Instead of damaging the plants infected, under normal conditions both bacteria and host plants flourish, the bacteria supplying the plants with nitrogenous foods and taking their own nourishment, in the form of carbohydrates, etc., from the host plants which build these compounds from water and the carbon dioxide of the air.

There are a number of different strains of the legume organism. Each strain infects a particular group of legumes but is unable to infect members of other groups. One strain infects clovers, another infects lucerne. Still another strain infects the lupin family. When a new legume is introduced into a country it is most probable that the particular strain of bacteria which associates with this legume is absent from the soils. It is then necessary to introduce with the legume its own particular strain of bacteria. Thus Soya beans failed in America until the correct strain of bacteria was imported from the Orient—the home of the Soya bean.

Lupins have been grown in the coastal regions of Western Australia for many years and in such situations usually carry nodules on their roots. The strain of bacteria peculiar to lupins was probably introduced with the lupin seed in the early days and spread with the lupin. At Merredin, however, the lupins have never formed nodules on their roots either on the slightly alkaline forest soils or on the slightly acid mallee soils. In view of this fact, it was decided to test this year the effect of inoculating the soil to be planted with lupins with small amounts of soil from the Chapman Experiment Farm which is known to carry the organism. The soil from Chapman was sprinkled in one row with the lupin seed while in the other row the seed was planted without any addition of the infected soil. As a result, the lupin plants growing in the row treated with soil from the Chapman Experiment Farm are heavily infected with the characteristic

root nodules while those from the untreated row are perfectly clean. Fig. 1 shows a representative member of the plants from each of the two rows. There can be no doubt as to the effectiveness of the inoculation. Very little

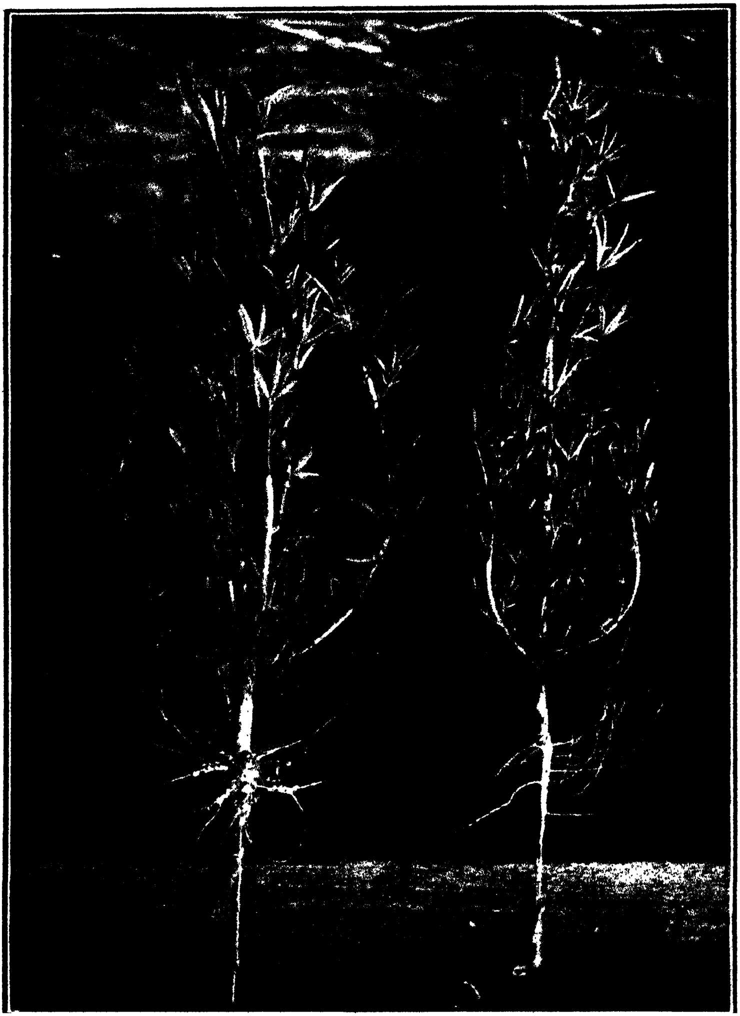


Fig. 1.

Lupin plants from uninoculated and inoculated soil at the Experiment Farm, Merredin, 27th August, 1929.

Left: Plant from uninoculated soil.

Right: Plant from inoculated soil.

Note the abundance of nodules on the roots of the plant grown in the inoculated soil. No nodules are to be found on the roots of the plant from the uninoculated soil.

difference is to be noted in the growth of the plants in the two rows at this time (27th August, 1929) probably owing to the natural richness of the Merredin soil with respect to nitrate-nitrogen. It will be interesting to observe the plants as they grow to maturity with and without the nodules.

It is quite possible, in fact very probable, that inoculation may be necessary for the most satisfactory growth of lupins on the poorer soils of the wheat belt when the lupin bacteria are not already present in the soil.

The authors wish to acknowledge their indebtedness to Mr. G. L. Sutton and Mr. H. A. Pittman who kindly read the manuscript and offered suggestions in connection with the preparation of the paper.

BEEKEEPING NOTES.

by

H. Willoughby Lance.
Apiculturist.

HIVE RECORDS.

The keeping of records is to-day one of the most essential factors in all important businesses, whether of production or distribution. The solving of important scientific problems often depends on the correct recording of facts, so that all factors that effect the problem may be studied as a whole over a period of time.

Successful beekeeping is no exception to the rule. When the colonies number dozens or perhaps hundreds, the mind that can retain all the essential points of the condition of the hives at the last inspection; the productiveness and general qualities of each Queen over a period of a couple of years; the blossoming period of the honey producing trees and their cycle of productiveness; is an exceptional one. Therefore, the beekeeper who wishes to obtain the best returns from his colonies needs to have his records in such a form as not to rely entirely upon memory.

The following are a few hints how this may best be done. To commence with all the colonies must be numbered either from one upwards, or by lettering of the rows or locations, and giving each hive in the row or location a number thus B 3 = row B, number 3 colony. Another method is

to place the hives in clusters of 5, and these clusters in rows; each row has a letter, and each cluster a number, as shown in Fig. 1. Then B. 4.3. would mean Row B, cluster 4, hive 3. The next is a note book which is equivalent

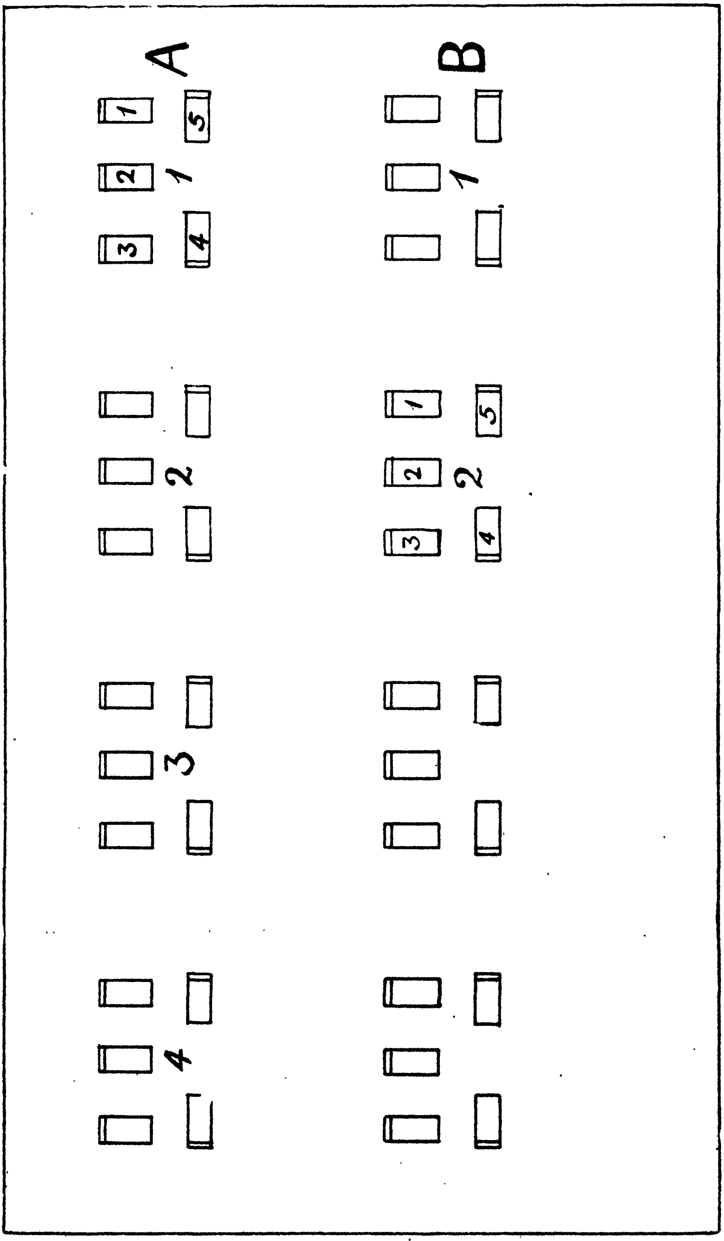


Fig. 1.

to the business man's day book. This should be entered up as the work progresses, and contain all the essential facts of the conditions and work done. For instance:

Aug. 13—Q R. Br. good. St. poor; means Queen right, Brood good, stores poor. This day book should be entered into what may be termed the ledger, which will be a record of each colony, and may be in the form of a book or by reference cards on the card index system. All the items in the day book need not be entered, only the essential ones showing the worth of the colony and queen, for instance the only one necessary from the above example would be Br. good.

Some beekeepers who use quilts, and a space between the quilts and the cover keep a large piece of cardboard here which acts as the ledger.

In a separate book or on cards, should be entered from time to time a record of the date when blossoms are observed on the various honey producing flowers or trees and later a note as to whether it was sparse or plentiful and the quantity and quality of the honey therefrom.

In many cases of records all one needs to know was the condition of the colony at the last inspection, indicating the probable work required. For this purpose, I have evolved a hive recorder which gives at a glance the condition and date of last inspection. This does away with entries in the day book which are not needed for the ledger.

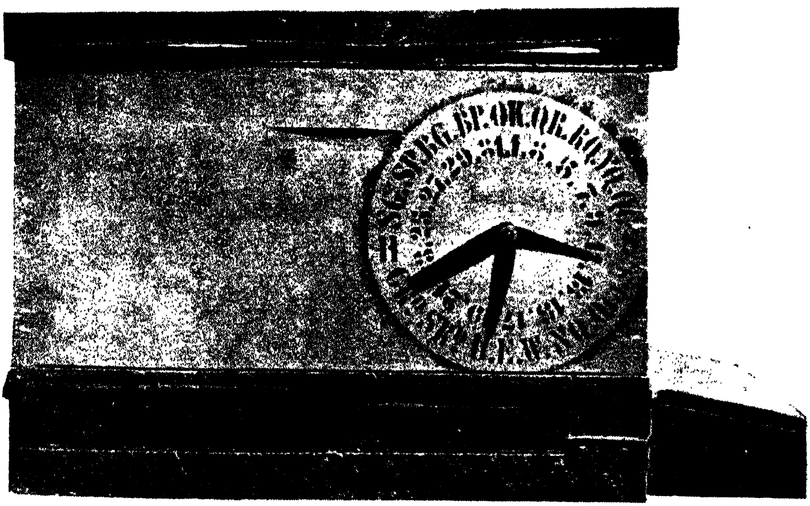


Fig. 2.

All that is needed is a stencil plate and a set of hands for each hive as illustrated herewith (Fig. 2.) The outer circle is the record of the condition of the hive and may have two or three hands as desired. The inner circle shows the day of the month of the inspection. If more than a month is likely to intervene before the next inspection, the month may be written in pencil at the side of the dial.

The interpretation of the letters on the large dial are as follows:—

Q R = Queen right
R Q = Requeen
Y Q = Young Queen
Q C = Queen clipped
S = Strong
Q cls = Queen cells
N Q = No queen
W = Weak
E = Examine
U = Unite
S Rd = Super required
C Rd = Combs required
H = Honey to come off
S G = Stores good
S P = Stores poor
B G = Brood good
B P = Brood poor
O K = All's well.

Very often an apiarist has not much time to spare and wishes only to attend to the most urgent work. With the above system, he would on arrival walk through his apiary, glance at the recorders, and make a note of the hives that want attention.

Figure 3 shows three hives on an antproof stand, particulars of which were given in the June number of the Journal. This stand has room for the placing of the supers between the hives when manipulating. The centre hive has been converted into a middle entrance hive for the purpose of Queen rearing and has a queen excluder between the two boxes. The usual alighting board has been removed and placed at the side of the hive, and the entrance blocked so that all bees must enter and leave from the centre.

It is intended as the hives are overhauled to convert all the floor boards to have detachable alighting boards as this is convenient when moving hives from one situation to another.

This photograph shows how easy it is with the recorders in use, to walk through the apiary and realise the condition of each hive at the last inspection.

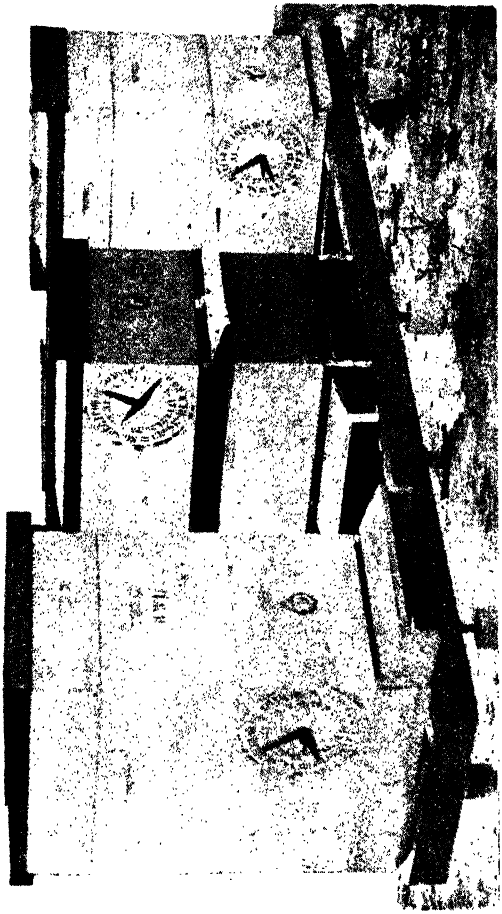


Fig. 3.

THE COST OF FEEDING PURE BRED COWS UNDER THE AUSTRALIAN OFFICIAL HERD RECORDING SCHEME.

P. G. HAMPSHIRE,
Sperintendent of Dairying.

P. C. COUSINS.
Senior Herd Recorder.

As has been the practice for the past six years, the details of the cost of feeding all cows submitted to the Australian Official Herd Recording Scheme have been carefully kept during last year, and the accompanying tables supply the data obtained. In Table 6 the averages under the various headings for six years' work are given.

During the year 14 pure bred herds have been tested, made up as follows: Jersey, 5; Milking Shorthorn, 4; Guernsey, 4; Red Poll, 1.

A slight improvement on 1928 figures is shown in the average yield, cost of feeding, and net profit per cow.

In the 14 herds referred to are included herds situated within the environs of the city of Perth, the outlying suburbs, and country districts.

Table I. contains the data for the year under review, and some interesting comparisons may be made of the different herds:—

—	Yield of Fat per Cow.	Cost of Feed per Cow.			Profit per Cow.		
	lbs.	£	s.	d.	£	s.	d.
Herd "D"	287	7	14	0	18	18	10
Herd "M"	323	25	18	0	3	18	3
Difference ...	36	18	4	0	15	0	7

Herd "D" and Herd "M" are of a similar breed, and both are country herds.

In regard to Herd "M," the cost of feeding is obviously expensive. Although situated in the country, this herd is confined to a small area where it is impossible to grow the major portion of the feed consumed, and the high cost of feeding the herd is, therefore, to a certain extent attributable to this factor. However, in this case the owner is a new entrant to the Herd Testing Scheme and at the outset was feeding a very expensive and unbalanced ration, which has been greatly improved upon as the result of advice offered by this Department.

From the above figures it will be seen that a herd yielding an average of 36 lbs. more butter fat in 9 months shows a profit of £15 0s. 7d. less per cow than a herd yielding 287 lbs. butter fat on an average. This is a definite

illustration of the fact that high average returns do not necessarily indicate high average profit returns.

A comparison between Herds "B" and "M" in the following table is also interesting, the herds being of similar breeds, and the yields of the cows being nearly the same:—

	Yield of Fat per Cow.	Cost of Feed per Cow.			Profit per Cow.		
	lbs.	£	s.	d.	£	s.	d.
Herd "B"	327	11	7	9	19	6	6
Herd "M"	323	25	18	0	3	18	3
Difference ...	4	14	10	3	15	8	3

The profit in this case is even more than that of the two herds illustrated previously, although the cost of feeding per cow in the case of Herd "B" was 50 per cent. greater than the cost of feeding Herd "D," the difference being accounted for by the higher average return received.

A comparison of Herds "D" and "B" is worth recording, and is as follows:—

	Yield of Fat per Cow.	Cost of Feed per Cow.			Profit per Cow.		
	lbs.	£	s.	d.	£	s.	d.
Herd "D"	287	7	14	0	18	18	10
Herd "B"	327	11	7	9	19	6	6
Difference ...	40	3	13	9	0	7	8

The difference, as will be seen, in the cost of feed is considerable, but the average profit per cow slightly favours Herd "B" by virtue of the increased production obtained.

A comparison of Herds "K" and "M" is worth noting in view of the fact that it shows that a poor average herd, even when expensively fed, does better than a herd of good average production most expensively fed:—

	Yield of Fat per Cow.	Cost of Feed per Cow.			Profit per Cow.		
	lbs.	£	s.	d.	£	s.	d.
Herd "K"	220	15	8	6	4	15	8
Herd "M"	323	25	18	0	3	18	3
Difference ...	103	10	9	6	0	17	5

In this case, a herd with an average of 103 lbs. butter fat less than another shows a slightly higher profit per cow. In neither case, however, is the profit sufficiently high to be considered economically profitable.

It will be recognised that, in making comparisons in the results of the different herds for the year ending 30th June, 1929, quite a number of factors must be taken into consideration, the main being the inherent productive capacity of the different cows in the herd, the manner in which they are managed and fed, and the situation or locality of the property on which the animals are located, the two principal factors, however, being "breeding" and "feeding." In the first place, the animals must be bred to produce, and in the second instance they must be fed economically. A dairy farmer to produce butter fat economically must, in addition to having stock that are bred to produce, grow the major portion of the feed on the property. The purchasing of expensive forms of stock feed is attended, as a rule, by unprofitable returns from dairy cows even in the case of fairly high production animals.

We have never favoured the introduction of a controversy in regard to the merits of the different breeds of dairy stock, as experience proves that there are good animals and good strains of animals in each of the main dairy breeds and that, having made due allowances for the differences of the climatic and pasturage conditions that may obtain, all of the good dairy breeds have their merits, the main consideration between two principal variations of the breeds being the marketing of the produce. Heavy milking breeds, such as the Milking Shorthorn and Ayrshire, are as a rule more economical as milk producers—where the sale of fresh milk is the main consideration—than the Channel Island breeds such as the Jersey and Guernsey. Where, however, the production of butter fat is the principal object, frequently the Channel Island breeds show to advantage when proper recording of the cost of feeding the cows is noted.

A comparison of the three principal dairy breeds in the herds represented under test will be of interest, the particulars of which are contained in the following table:—

———	Average Yield of Fat.	Average Cost of Feed for period.	Average Profit as Fat over Cost of Feed.	Average Profit as Milk over Cost of Feed.
	lbs.	£ s. d.	£ s. d.	£ s. d.
Guernsey (4 herds) ...	293	13 17 10	13 6 11	16 2 9
Milking Shorthorn (4 herds)	288	16 2 5	11 19 5	21 5 7
Jersey (5 herds) ...	296	14 14 3	11 1 6	12 17 4

The results show that the average yields of the herds of the different breeds are comparatively even, with a slight advantage to the Jersey, the next in order being the Guernsey, whereas the cost of feed of the different herds favours the Guernsey, with the Jersey next in order. The profit from the sale of the productions as fat favours the Guernsey, with Milking Shorthorn next in order, and the profit from the sale of the production as milk strongly favours the Milking Shorthorn, with Guernsey following.

The herds shown in the above table are situated in different parts of the State and might reasonably be taken as an average of the breeds, but in fairness to the Jersey herds it should be stated that one is not up to the average

standard of production and two of them are being expensively fed. The same also applies in regard to one Guernsey herd, and in the case of Milking Shorthorns the average cost of feeding the herds is fairly constant, the difference being accounted for by the high calibre of the production of the herds. For instance, one Milking Shorthorn herd shows a profit of £30 2s. 11d. per cow over cost of feed, when the produce is sold as milk at 1s. 3d. per gallon, whereas another herd shows a profit of only £11 5s. 4d. per cow. There are, however, greater variations in the yields of the Jerseys and Quernsey herds in regard to the profits of the herds over cost of feeding, which is largely accounted for by the high average production of the top herds. The cost of feeding for the average pound of fat produced shows a marked difference and varies in the case of Herd "D" at 6.44d. per lb. of fat produced to, in the case of Herd "N," 20.21d. per lb., the average of all herds being 12.24d. per lb. of fat. In regard to milk production, the variation again is marked, the difference being from 3.29d. to 11.63d. per gallon, the average for all herds being 5.74d.

Table VI. discloses the results of six years' recording and may be taken as a very true average under all conditions, taking into consideration good, fair, and poor cows; good, fair average, and poor managers; good, medium, and poor feeders: good, fair and poor farms, situated in the city, suburban, and country districts, with the principal dairy breeds under test. A point, however, that should be considered is that, apart from the first year that Herd Testing was in operation, when the majority of the cows under test were mature animals, the majority of the animals entered for test since that period have been young stock on their first, second, or third lactation, especially during the last three years. The averages obtained, therefore, may be taken as reasonably reliable, and are as follow:—

Average Yield per Cow.		Average Value of Skim Milk.	Average Cost of Feed per Cow for period.	Average Profit per Cow on average price obtained for Butter Fat.	Average Profit where Milk sold at 1/3 per gallon over Cost of Feed.	Average Cost to produce 1lb. of Butter Fat.	Average Cost to produce one gallon of Milk.
Milk.	Butter. Fat.						
gall.	lbs.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	pence.	pence.
616	301·08	3 2 10	14 2 6	12 16 11	17 11 7	11·2	5·62

TABLE I.—HERDS IN ORDER OF MERIT AS PRODUCERS OF BUTTER FAT, YEAR ENDED 30TH JUNE, 1929.

Columns.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Herd.	Average Fat per Cow for Period of 9 months.	Average Skim Milk per Cow for Period.	Value of Fat for Period at 1s. 8d. per lb.	Value of Skim Milk for Period at 2d. per gallon.	Average Value of Fat and Skim Milk per Cow for Period.	Cost of Feed per Cow for Period.	Net Profit per Cow for Period through sale of Fat.	Value of Whole Milk at 1s. 3d. per gallon allowing for rearing calf.	Net Profit per Cow by sale of fresh milk milk af 1s. 3d. per gallon.	Cost of Feed per 100lbs. Fat.	Cost of Feed per gallon of Milk.
	lbs.	gall.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.
A	370·09	670¼	30 16 10	5 11 9	36 8 7	15 10 3	20 18 4	52 3 4	36 13 1	4 3 10	3·94
B	327·60	409¼	27 6 0	3 8 3	30 14 3	11 7 9	19 6 6	35 5 3	23 17 6	3 9 7	4·16
C	377·70	591	31 9 6	4 18 6	36 8 0	17 2 4	19 5 8	47 5 3	30 2 11	4 10 9	4·79
D	287·18	325	23 18 8	2 14 2	26 12 10	7 14 0	18 18 10	29 10 11	21 16 11	2 13 8	3·29
E	302·13	536	25 13 6	4 19 4	30 12 10	13 8 6	17 4 4	42 18 10	29 10 4	4 8 10	4·04
F	291·97	368	24 6 8	3 1 4	27 8 0	11 0 7	16 7 5	31 16 11	20 16 4	3 15 6	4·34
G	291·70	287	24 6 2	2 7 10	26 14 0	11 11 6	15 2 6	27 9 9	15 18 3	3 19 3	5·35
H	345·30	359	28 15 6	2 19 10	31 15 4	16 17 7	14 17 9	32 13 9	15 16 2	4 17 10	6·76
I	281·64	337	23 9 4	2 16 2	26 5 6	11 17 6	14 8 0	30 3 0	18 5 6	4 4 2	4·96
J	262·87	374	21 18 4	3 2 4	25 0 8	17 16 1	7 4 7	31 19 9	14 3 8	6 15 4	6·93
K	220·55	219	18 7 8	1 16 6	20 4 2	15 8 6	4 15 8	22 0 7	6 12 1	7 0 3	8·35
L	212·11	314	17 13 6	2 12 4	20 5 10	16 2 9	4 3 1	27 8 1	11 5 4	7 12 3	7·05
M	323·85	345	26 19 9	2 17 6	29 16 3	25 18 0	3 18 3	31 8 7	5 10 7	7 19 10	10·66
N	206·33	142	17 3 10	1 3 8	18 7 6	17 7 2	1 0 4	17 12 0	0 4 10	8 8 5	11·63
Averages ...	295·10	386	24 11 10	3 4 4	27 16 2	15 1 0	12 15 2	33 6 9	18 5 9	5 2 0	5·74

AVERAGE COSTS OF FEEDS.

Oaten or Wheaten Chaff, £5 per ton; Bran, £8 5s. per ton; Pollard, £9 5s. per ton; Crushed Oats, 3s. per bushel; Linseed Meal, £13 10s. per ton; Lucerne pasture, 3s. per week; Lucerne Hay, £7 per ton; Green Maize, 7s. per ton; Silage, 7s. per ton; Brewer's Grains, 6d. per bushel; Pasture, 1s. 6d. per week; Soudan Grass Pasture, 3s. per week, or 7s. per ton; Subterranean Clover Pasture, 3s. per week; Green Lucerne, £2 per ton; Barley, green, 7s. per ton, or 3s. per week as pasture; Clover Hay, £3 10s ton. per.

AVERAGES OF ALL COWS RECORDED.

TABLE II.

	£ s. d.
1.—629 gallons of Milk, and 295·1lbs. Butter Fat.	
2.—386 gallons of Skim Milk per Cow.	
3.—Value of Butter Fat at 1s 8d. per lb.	24 11 10
4.—Value of Skim Milk available for Pig feeding	3 4 4
5.—Total credits to Cow by sale of Butter Fat and Skim Milk	27 16 2
6.—Cost of Feed for period	15 1 0
7.—Profit by sale of Butter Fat after deducting feed costs	12 15 2
8.—Value of Whole Milk if sold at 1s. 3d. per gallon	33 6 9
9.—Profit by sale of Fresh Milk at 1s 3d. per gallon after deducting cost of Feed	18 5 9
10.—Cost of Feed per 100lbs. Butter Fat produced	5 2 0
11.—Cost of Feed per gallon of Milk produced	5·74

HERDS IN ORDER OF MERIT AS PRODUCERS OF MILK.

TABLE III.

Herd.	Milk Average Gals.	Butter Fat, Average lbs.	Cost of Feed per Cow.	Profit a. Milk.	Profit as Fat.	Cost to Produce 100lbs. Fat.	Cost to Produce 1 gallon Milk.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.
A	945	370·09	15 10 3	36 13 1	20 18 4	4 3 10	3·94
C	857	377·70	17 2 4	30 2 11	19 5 8	4 10 9	4·79
E	796	302·13	13 8 6	29 10 4	17 4 4	4 8 10	4·04
B	655	327·60	11 7 9	23 17 6	19 6 6	3 9 7	4·16
D	561	287·18	7 14 0	21 16 11	18 18 10	2 13 8	3·29
F	609	291·97	11 0 7	20 16 4	16 7 5	3 15 6	4·34
I	574	281·64	11 17 6	18 5 6	14 8 0	4 4 2	4·96
G	519	291·70	11 11 6	15 18 3	15 2 6	3 19 3	5·35
H	599	345·30	16 7 7	15 16 2	14 17 9	4 17 10	6·76
J	615	262·87	17 16 1	14 3 8	7 4 7	6 15 4	6·93
L	549	212·11	16 2 9	11 5 4	4 3 1	7 12 3	7·05
K	443	220·55	15 8 6	6 12 1	4 15 8	7 0 3	8·35
M	583	323·85	25 18 0	5 10 7	3 18 3	7 19 10	10·66
N	358	206·33	17 7 2	0 4 10	1 0 4	8 8 5	11·63
Averages ...	629	295·10	15 1 0	18 5 9	12 15 2	5 2 0	5·74

HERDS IN ORDER OF MERIT SHOWING COST OF FEED PER 100 LBS. FAT.

TABLE IV.

Herd.	Cost of Feed per 100lbs. Fat.	Under Average.	Over Average.
	£ s. d.	£ s. d.	£ s. d.
D	2 13 8	2 8 4	
B	3 9 7	1 12 5	
F	3 15 6	1 6 6	
G	3 19 3	1 2 9	
A	4 3 10	0 18 2	
I	4 4 2	0 17 10	
E	4 8 10	0 13 2	
C	4 10 9	0 11 3	
H	4 17 10	0 4 2	
J	6 15 4	...	1 13 4
K	7 0 3	...	1 18 3
L	7 12 3	...	2 10 3
M	7 19 10	...	2 17 10
N	8 8 5	...	3 6 5

Average of all Herds—£5 2s. 0d.

HERDS IN ORDER OF MERIT, SHOWING COST OF FEED PER GALLON OF MILK PRODUCED.

TABLE V.

Herd.	Cost of Feed per gallon of Milk.	Under Average.	Over Average.
	d.	d.	d.
D	3·29	2·45	
A	3·94	1·80	
E	4·04	1·70	
B	4·16	1·58	
F	4·34	1·40	
C	4·79	·95	
I	4·96	·78	
G	5·35	·39	
H	6·76	...	1·02
J	6·93	...	1·19
L	7·05	...	1·31
K	8·35	...	2·61
M	10·66	...	4·92
N	11·63	...	5·89

Average—All Herds—d. 5·74.

HERD AVERAGES FOR 6 YEARS—1924-1929.

TABLE VI.

Year.	Milk.	Average Fat per Cow for Period of 9 months.	Average Skim Milk per Cow for Period.	Value of Fat for Period.	Value of Skim Milk for Period at 2d. per gallon.	Average Value of Fat and Skim Milk per Cow for Period.	Cost of Feed per Cow for Period	Net Profit per Cow for Period through sale of Fat.	Value of Whole Milk at 1s. 3d. per gallon allowing for rearing calf.	Net Profit per Cow by sale of Fresh Milk at 1s. 3d. per gallon.	Average Cost to produce 1lb. of Fat.	Average Cost to produce1 gallon of Milk.
	galls.	lbs.	galls.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Pence.	Pence.
1929 ...	629	295·10	386	(at 1s. 8d. per lb.) 24 11 10	3 4 4	27 16 2	15 1 0	12 15 2	33 6 9	18 5 9	12·24	5·74
1928 ...	592	280·56	353	(at 1s. 7½d. per lb.) 22 15 9	2 18 10	25 14 7	15 11 4	10 3 3	30 19 0	15 7 8	13·34	6·31
1927 ...	602	290·72	362	(at 1s. 7d. per lb.) 23 0 4	3 0 4	26 0 8	14 10 5	12 6 8	31 10 6	17 0 1	12·00	5·79
1926 ...	624	312·01	393	(at 1s. 7d. per lb.) 24 14 0	3 5 6	27 19 6	14 14 7	13 4 11	32 5 5	17 10 10	11·15	5·66
1925 ...	652	308·59	407	(at 1s. 5½d. per. lb) 22 10 0	3 7 10	25 17 10	14 13 2	11 4 8	30 10 5	15 9 5	10·77	6·15
1924 ...	600	319·50	362	(at 1s. 7½d. per lb.) 25 19 2	3 0 4	28 19 6	10 4 10	18 4 8	32 1 3	21 16 5	7·7	4·09
Average for 6 years	616	301·08	377	(at 1s. 7d. per lb.) 23 16 7	3 2 10	26 19 5	14 2 6	12 16 11	31 15 6	17 11 7	11·20	5·62

THE EELWORM-GALL OR ROOT-KNOT DISEASE.

(Caused by *Caconema radicicola* (Greef) Cobb, formerly known as *Heterodera radicicola* (Greef) Müller.)

H. A. PITTMAN, B.Sc.Agr.,
Plant Pathologist.

Although apparently unknown in the south-western portions of this State, *Caconema radicicola,* the organism responsible for the development of eelworm-galls or root-knots on the underground portions of many of our cultivated plants, is widely distributed in the metropolitan zone around Perth, and has recently attracted considerable attention in the light sandy soils of the Geraldton area. (Fig. 1.)

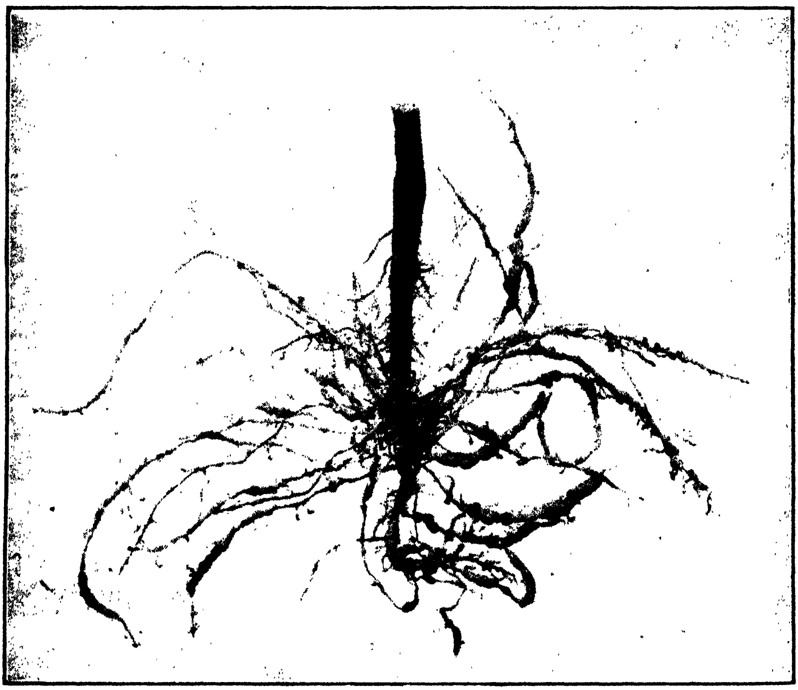


Fig. 1.
Eelworm-galls on roots of young tomato plant from Geraldton.

Photo. by Author.

The eelworms in question are very small round worms, somewhat less than 1/25 inch in length, which may attack the underground parts and form galls on almost all our cultivated species with the exception of most grasses and cereals (wheat, oats, barley, rye, maize, etc.) and a limited number of other plants.

In Western Australia the worms have been found forming galls on the roots or other underground-parts of potatoes, tomatoes, cape-gooseberries, marrows, pumpkins, melons, cucumbers, carrots, parsnips, beetroot, beans, mangolds, tobacco, rhubarb, grapes, figs, banana, dahlia, boronia, *Ceinfugosia hakeifolia,* wattles, and many other plants of an edible, flowering, or ornamental nature. Cauliflowers, cabbages, peas, asparagus, artichoke, spinach, onions, and sweet potatoes are not usually attacked to such an extent as the other market-garden plants previously mentioned. Considerable differences in varietal susceptibility occur in almost all plant species attacked. ***The eelworms are rarely, if ever, found in heavy clay soils, but thrive abundantly in loose, well-drained, sandy soils in warm districts or situations.*** It is on this account that eelworms have so successfully established themselves in the Perth district and environs. The disease is very serious in many parts of the world where flowers or vegetables are grown under glass, and under such circumstances periodic sterilization of the soil by means of steam is commonly practiced to rid the soil of the pest. Unfortunately this method is at present quite impracticable in Western Australia.

Symptoms and Effects.

Plants badly affected are dwarfed, wilt readily in hot weather, and are usually a paler green than healthy ones. Seedlings and even older plants may be killed in quick time if severely attacked, or great reduction in yield may result. Sometimes, however, little damage or reduction in yield is apparent, *especially if abundance of water, fertiliser and organic matter can be supplied to the plants.* In this connection it is very well worthy of note that any means which tend to reduce the proportion of top-growth to rooting system (such as pruning out of excess lateral shoots in tomatoes and the copious use of superphosphate and sulphate of potash) will tend to reduce the injury done by the worms.

On being pulled up infected plants will be found to show more or less numerous warts or swellings of the roots or other underground-parts. Potatoes are usually attacked on the tubers, but the organisms may also invade the roots and underground stems. Infected potato tubers show many or few, more or less scattered, flat-topped pimples or blisters on the surface, often about one-eighth inch in diameter and elevated about the same distance above the general level of the healthy tissues. (Fig. 2.) The lesions may be much larger, however, in certain cases, and where attack is bad may be very close together, giving a much distorted appearance to the affected parts. Sometimes numbers of the blisters will be found to be broken open or decayed as a result of subsequent attack by fungi or bacteria. If infected potatoes are cut open, small brown areas will be seen in the flesh under the pimples and extending to a depth of about ¼" in some cases. It is in these brown areas that the eelworms occur, but on account of their very small size the males and young are not readily seen without a strong lens or microscope. The mature egg-filled females, however, are much broader than the other stages, being pear-shaped and about 1/25th inch in diameter, and they can sometimes be distinguished with the naked eye as glistening pearly-white bodies within the discoloured tissues. Eelworms are often introduced into clean land in potato peelings, and this may be considered one of the main means of dissemination by unsuspecting persons. The use of the manure of animals fed on infected plants also leads to the

Fig. 2.

Eelworm-galls due to *Caconema* (*Heterodera*) *radicicola* on potato-tubers.

distribution of the worms, as they are not all destroyed by passing through the intestines.

Carrots, parsnips and other fleshy-rooted plants may show large warts which greatly disfigure the appearance of the edible portions (Figs. 3 and 4). On plants with more slender underground parts, the galls or warts may somewhat resemble the bacterial nodules which are so necessary a feature

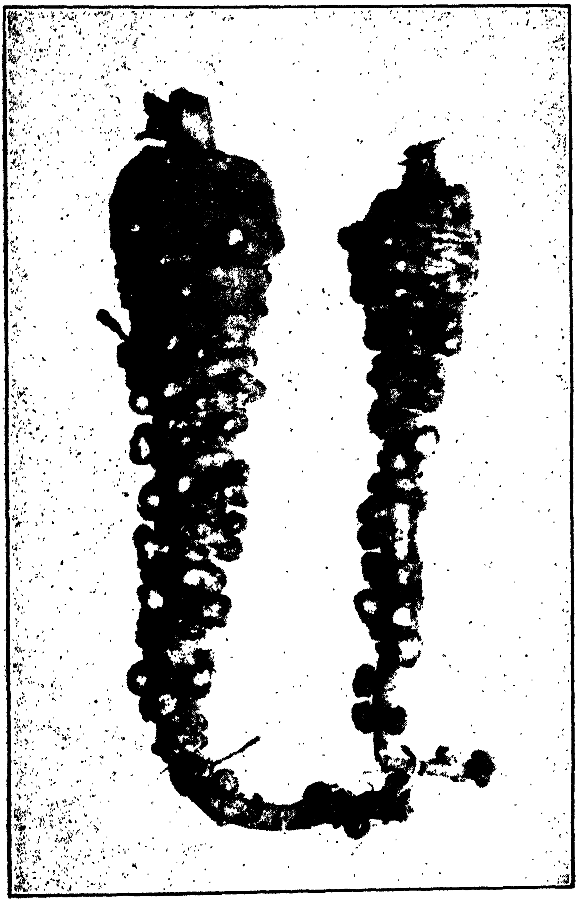


Fig. 3.
Eelworm-galls on parsnips.
Photo. by Author.

on the roots of plants belonging to the pea or bean family (*Leguminosae*). Even on such plants, however, the experienced eye soon learns to detect the eelworm-galls if present in addition to the bacterial nodules. The eelworm-galls on these plants are often very close to the root tips—they are mostly much more elongated, cylindrical and narrow than the bacterial nodules, and they follow the *length* of the roots or rootlets rather than jut

out as large swellings to the side, as do the nodules due to the bacteria. *They are, in short, on leguminous plants generally longitudinal swellings of the root* rather than more or less knobby lateral outgrowths. (Figs. 5 and 6). Plants of the cabbage family (*Cruciferae*) are sometimes attacked on the roots by the Club-root organism—*Plasmodiophora brassicae*—but the swellings in such a case are enormously larger and are easily distinguishable from eelworm-galls.

Life History.

The young eelworms or "larvae" which hatch out of the eggs laid in the old galls eventually puncture the roots of the host plant by means of spear-like structures in the mouth parts called *buccal-spears*, and enter into tissues of the root or similar part just behind the growing points. By their presence the root or tuber, etc., is stimulated to unusual activity and the characteristic galls result. On attaining full size the male and female eel-

Fig. 4.
Eelworm-galls on dahlia-tubers.
Photo by Author.

worms mate, and subsequently the female becomes greatly distended and may produce as many as five hundred eggs. In loose, warm, moist soils, up to twelve generations may be produced in a year, as the life cycle can, under such circumstances, be completed in four to five weeks. The "larvae" and adult males are elongated and like miniature earth-worms in shape, but the fertilized females are pear-shaped on account of the body being distended with eggs (Fig. 7).

Fig. 5.

Eelworm-galls on garden-pea. Note the long, sub-cylindrical nature of the galls. Several bacterial nodules occur at the points marked X.

Photo. by Author.

Susceptible Plants.

For general information the following list of the most important susceptible plants is taken from Heald's "Manual of Plant Diseases":—

1. *Field crops.*—Alfalfa (lucerne), clover, cotton, cowpea (most varieties), sugar beet, sugar cane, sweet potato, tobacco, and vetch.

2. *Ornamental and drug plants.*—Begonia, cineraria, clematis, coleus, dahlia, hollyhock, ginseng, golden seal, peony, rose, sweet pea, and violet.

3. *Truck crops.*—Asparagus, bean, beet, carrot, celery, cucumber, dasheen, eggplant, garden pea, lettuce, okra, onion, pepper, potato, rockmelon, salsify, spinach, strawberry, tomato, and water melon.

4. *Woody plants.*—Almond, catalpa, cherry, date palm, European elm, mulberry, grape, peach, pecan, walnut, and weeping willow.

Resistant Plants.

Nearly all grasses; cereals such as wheat, barley, oats, rye, maize, and sorghum; "Iron," "Brabham," "Monetta," and "Victor" cowpeas; peanut; "Laredo" soy bean; velvet bean.

CONTROL.

1. Farmers or householders should be very careful never to plant potato tubers or seedlings of any kind showing eelworm-galls. (The Potato Branch of this Department is taking every possible precaution to prevent the carrying of eelworm-infested plants into the potato-growing area of the Southwest, but an odd specimen or two might at any time find its way past the barriers.) *If your farm or home garden is free at present, do all you can to keep it free.* This means, among other things, raising your own seedings and boiling the peelings of any potato tubers used for household purposes which appear to be infested with eelworms. It is very likely that the eelworms have been chiefly carried about the State in potato tubers and introduced into the gardens and fields in the potato peelings. *The true seeds of plants as distinct from tubers, bulbs, etc., do not carry the eelworms.*

2. (a) In seedbeds the eelworms can be destroyed by treating the soil with *carbon-bisulphide* at the rate of 1½-2 ozs. per square yard before sowing the seed. Make four evenly-spaced holes 8 inches deep to every square yard of soil with a round stick. Into each pour, per medium of a funnel, approximately ¼-½ fluid ounce of the carbon-bisulphide and quickly cover with moist earth. Cover the seedbed with clean bags and leave for several days. Then aerate thoroughly by turning over several times and leaving stand for several days before planting the seed.

(b) Where carnations, dahlias and other flowering or ornamental plants in gardens are found to be attacked, the eelworms can be largely killed by treating the soil with *one fluid ounce carbon-bisulphide to the square yard in evenly-spaced holes not closer than 9 inches to the base of the plants.* After pouring the required amount down each hole (about ¼ ounce), close the hole with moist earth. The fumes will spread through the soil and kill many of the eelworms in the soil and roots. Both the above-mentioned treatments have been tested out over a considerable period of years by Mr. L. J. Newman, Economic Entomologist of this Department, with satisfactory results. Do not water the soil for several days after treating or the carbon-bisulphide may be forced out of the soil. **Above all, remember that carbon-bisulphide is exceedingly inflammable and explosive in the presence of a spark, lighted cigarette or flame. The fumes are also poisonous if inhaled for any length of time, so that the fumigant must be handled with all due discretion.**

(c) Experience in America and other countries indicates that *formalin* may be used fairly satisfactorily for treating eelworms in seed beds. The formula now being mostly recommended is 1 gallon of formalin to 50 gallons of water (*i.e.*, a so-called 2 per cent. solution). The solution is applied with a watering-can to the soil, which should previously have been well

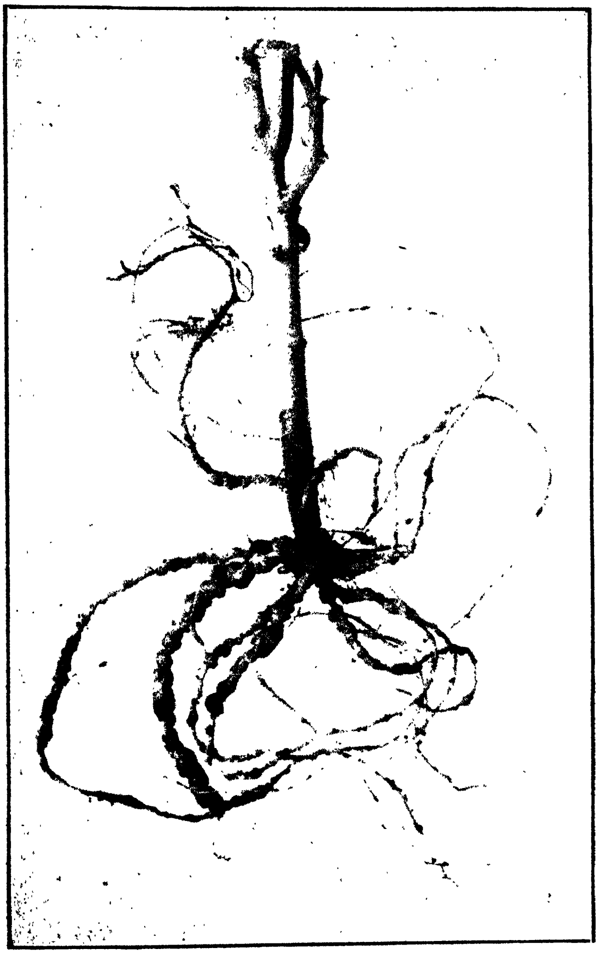


Fig. 6.

Eelworm-galls on French bean.

Photo. by Author.

loosened up, at the rate of about ½-1½ gallons of the solution to the square foot (1). Cover the soil with bags moistened with the solution and leave for several days. Then remove the bags and stir the soil up thoroughly to let out the fumes. Leave for 10 days or a fortnight before sowing. This

treatment is exceptionally efficient for destroying such soil fungi as cause "damping-off" and "root-rot" and it also appears to give fairly good results with eelworms. Be careful, however, not to re-contaminate the soil by using dirty implements from infested ground, or by walking over the beds with contaminated boots, etc.

(d) Eelworms can be killed out by suffocation, if the soil in the seed-beds or field can be kept flooded with water for 3-4 weeks. In such a case, however, the soil must, of course, be freed of excess of water and well aerated before sowing the seeds or planting out.

(e) In many countries steam-sterilization is used to free the soil in glass houses from eel-worms, with extremely effective results, but the method is impracticable here.

(f) J. R. Watson (2), of the Agricultural Experiment Station, University of Florida, who has given considerable attention to the control of eelworms in the light sandy soils of Florida over many years, recommends a treatment for seed-beds from which the following details have been worked out (3). First of all, dig over the seed-beds thoroughly, then water with *sodium cyanide* solution at the rate of three ounces of the solid cyanide to each square yard of soil. Add further water until the soil is moistened to a depth of 18 inches throughout. Then *immediately afterwards* sprinkle four and a half ounces (4½ ozs.) of *sulphate of ammonia* over each square yard and water in with just sufficient water to carry the sulphate down. The two chemicals react with one another, forming sodium sulphate, ammonia, and hydrocyanic acid gas (prussic acid), which kills the eelworms. Watson (*loc. cit.*) states: "If nematodes (eelworms) appear at all in such seed-beds, they will be in isolated spots which can be rejected at planting time. If, on the other hand, the desire is for plants which can be depended upon to be absolutely free, as for setting in uninfested ground, application of at least 1,200 lbs. cyanide (of sodium) and 1,800 lbs. ammonium sulphate to the acre should be applied"—*i.e.*, about 4 ounces of the cyanide and 6 ounces of the sulphate of ammonia to each square yard.

Cyanide of potassium can be used instead of cyanide of sodium, and from the point of view of subsequent soil fertility, would appear to be considerably superior to the sodium compound. It has the disadvantage of greater cost, however, and, in addition, one must use one-third more of the potassium cyanide to each square yard, *i.e.*, 4 ounces, instead of 3 ounces of the sodium cyanide. The amount of sulphate of ammonia is, however, the same in each case. If the above method is used for sterilizing seed beds, **great care must be exercised in handling the cyanide as it is one of the most deadly poisonous substances known to science. In the case of poisoning, immediately give a weak solution of green sulphate of iron (ferrous sulphate or "green vitriol") as a drink, and then empty the stomach by means of a stomach tube or by inducing vomiting with a mustard emetic. Send post haste for medical assistance. Above all do not use the cyanide method unless you have a supply of the antidote ready in case of need and have carefully instructed all the persons concerned in its use. The poison is so powerful and rapid in its action that unless treatment is immediate there is very little hope.**

3. On a field scale every encouragement should be given to the plants in the way of water, organic matter, and fertiliser to enable them to stand up to attack. Tomatoes should be pruned to a single stem and tied up to

stakes. The reduction in the excessive top growth may then make it possible to obtain fairly heavy yields even though the roots are rather badly attacked.

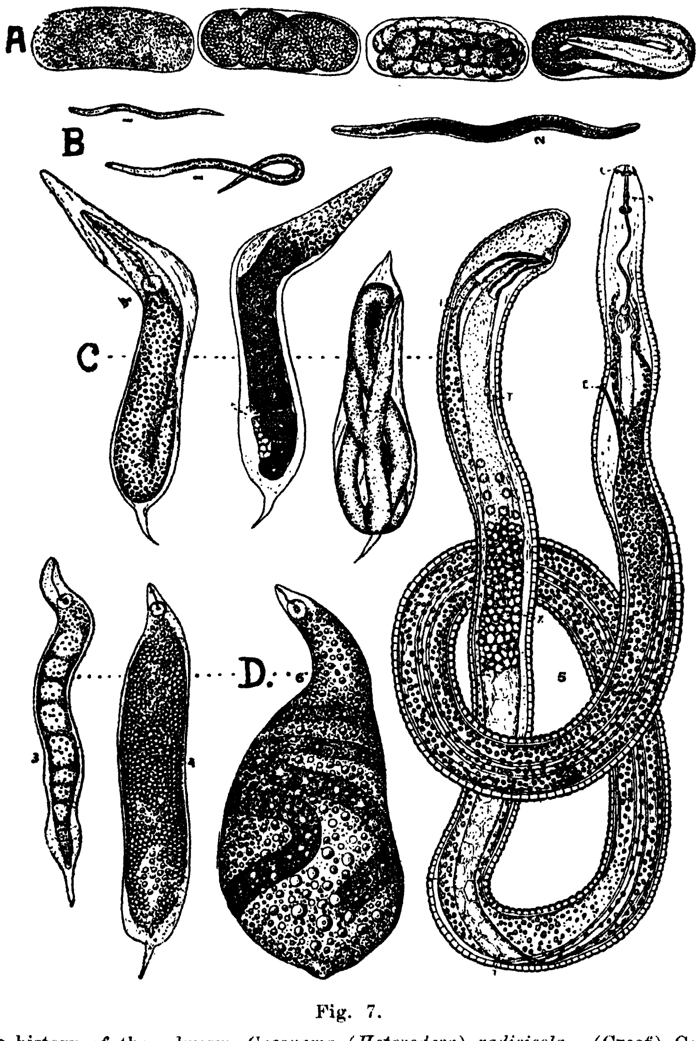


Fig. 7.

Life history of the eelworm, *Caconema* (*Heterodera*) *radicicola.* (Greef) Cobb.
A, Four stages in development of the egg.
B, Stages in the growth of young worms.
C, Four stages in development of male.
D, Three stages in development of female.
(*After Stone, G. E., and Smith, R. E., Mass. Agric. Expt. Sta. Bull.* 55, 1898.)

4. Where the soil *in the field* is badly contaminated with the pest, *well-worked summer fallow* should be practised, as in such a case the drying out of the soil kills great numbers of the parasites. The following season a

resistant crop (such as wheat or oats, etc.) should be sown, and then the susceptible crop can be sown with little fear the next season. This means that on badly infested tomato fields, for instance, the tomatoes should only be grown on the same land every third season. A division of the cultivated land into three more or less equal parts therefore seems imperative when the eelworms become firmly established. This means, of course, that the smaller area must be very intensively worked while it is in crop, but each year a comparatively clean area would be available for the main money-making plants. All weeds liable to harbour the worms should be prevented from growing along the headlands and ditches, etc.

5. Experiments recently reported by Edwards (4) in England indicate that good results might be obtained on a field scale by ploughing-in crude naphthalene to a depth of 6 inches, at the rate of eight hundredweights (8 cwts.) to the acre, followed by rolling, about a fortnight or so before planting. In the experiments referred to, very striking results were obtained in the treatment of a "potato-sick" soil where there was a very heavy mixed infestation of the soil with another species of eelworm, *Heterodera schactii*, and the fungus *Rhizoctonia solani*. The material actually used was "drained creosote salts" (stated to be a crude form of Napthalene), selling in England for about 10s. per cwt. Inquiries made in Perth indicate that the material cannot be obtained locally, but Messrs, De Merics, Ltd., of 255 George Street, Sydney, N.S.W., advise that supplies of a crude Naphthalene can be delivered by them f.o.b. Sydney at prices ranging from £16-£33 per ton, *i.e.*, 16s. to £1 13s. per cwt., according to the grade of purity. Even at the higher price an outlay of £13 4s. per acre should not be prohibitive, if good results were obtained, with such crops as tomatoes which in the Geraldton district are stated to sometimes give a gross return of over £500 per acre. Any farmers desirous of carrying out experiments could arrange for supplies in quantity from the firm mentioned. Experiments by the Department are projected to test the actual efficacy of the treatment for the local eelworm, *Caconema (Heterodera) radicicola*.

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CERTIFICATION OF SEED POTATOES.

REVIEW OF SEASON 1928-29.

W. E. COLLINS, Potato Inspector.

Before proceeding with the present review, it may not be out of place to outline the salient features of the Seed Potato Certification Scheme established by the Potato Branch in 1922.

The object of potato seed certification is to obtain good seed; that is, seed true to name, unmixed with other varieties, capable under good cultural conditions of producing high yields of marketable tubers. Seed to do this, must have come from stock that has itself performed well and has presented the properties that we expect of its product. It must be free to a large extent of those factors, particularly those of transmissable diseases, that are capable of reducing the yields.

With the increasing prevalence and number of diseases of potatoes, and the greater risk in purchasing seed stocks about which nothing is known by the purchaser, has come the realisation that the production of satisfactory seed requires special knowledge and care.

Consequently, there has been developed in this State during the past seven years a system of seed certification, designed to locate and make available to the seed buying public a supply or more or less standardised seed potatoes of good quality and productiveness: a service to judge what stock is good for seed, and to mark that stock in such a way as to assure those who purchase it, that it is good.

To accomplish this, crops entered for certification are inspected twice during the growing period, and again at digging and grading time by officers of the Potato Branch to determine as accurately as possible whether the potatoes come up to the required standard for Certified Seed.

The principal requirements are:—

1. Trueness to name.
2. A type true for the variety.
3. Relative freedom from disease.

The standard set is high enough to exclude all but first class stock, but not so high as to make it impossible or to discourage growers from attempting to grow good seed, but good seed must be produced before it can be certified to and there is a chance for much improvement yet.

Careful "rogueing" is insisted on and is absolutely necessary to produce high grade seed. The crops should be rogued not once, but a number of times during the growing season. Many Certified Seed growers have made the mistake of waiting until the plants are nearly mature before "rogueing," overlooking the fact that plants infected with certain diseases were thus allowed a long period to transmit the diseases to their healthy neighbours. Early "rogueing" will reduce the amount of disease in future crops.

An excellent opportunity offers the southern grower with his carefully racked seed, to minimise his weakly and abnormal plants by rejecting all doubtful tubers at the time of planting and satisfying himself by cutting a cross section at the heel end of the potato, that there is no internal discoloration, thereby reducing the possibility of "stem end" trouble. That the opportunity for the extension of potato seed certification is great, can be realised better when we consider that the total amount of certified seed produced last season would plant less than a sixth part of the potato acreage of the State. About 30,000 bags of seed are required to plant the potato areas of the southwest each year—5,000 bags of tubers were certified to in the past season—hence it is seen that there is still plenty of room for expansion in production of Certified Seed.

The benefits to potato growers from the planting of Certified Seed are so apparent, that extension in the movement is inevitable. We have but to see the failures in potato yields due to poor seed, to strengthen our belief.

Certified Seed necessarily commands a considerable premium over that which has not been inspected, but the extra cost is slight as compared to the increased yields which may be expected from the use of good seed, and the crop insurance which it affords. Certified Seed has in general justified the extra trouble and expense in producing it.

Naturally buyers are interested in knowing whether, aside from all theoretical considerations, Certified Seed actually yields more than common stock. In the Burekup-Roelands district where average yields from several certified and uncertified strains were taken, there was a gain of from 4-6 tons per acre for the Certified Seed. At Osborne Park Certified Seed averaged an increase of 5 tons to the acre.

These illustrations indicate that the principles on which seed potatoes are certified have a firm foundation. It is nevertheless, true that some lots of Certified Seed were not quite satisfactory. Such cases involved less than a ton of tubers and on examination, were found to be from quite uncontrollable causes.

For instance, there is on the surface of some tubers a black pitting of the skin known as "storage trouble," which, however, is not regarded as serious from a seed stand-point, unless the injury extends deeply, when the rotting of the set may occur. This trouble shows up irregularly in most potato growing areas of the State, and usually appears about 6 weeks after digging. There is no indication of the trouble during the growing period or at the time of digging. Very little of it is known actually, but with the assistance of the Government Plant Pathologist, who is now investigating it, a control measure may eventually be discovered.

Growers of Certified Seed are trying as never before, to improve on their efforts, and their Associations are zealous that the stock sent out under their name will be as nearly perfect as it is possible to grow it.

Every man has his ideals—

***And naturally** it is to be expected that SOME REFLECTION of these ideals would be found in his HOME LIFE of which the HOME ITSELF forms an integral part.*

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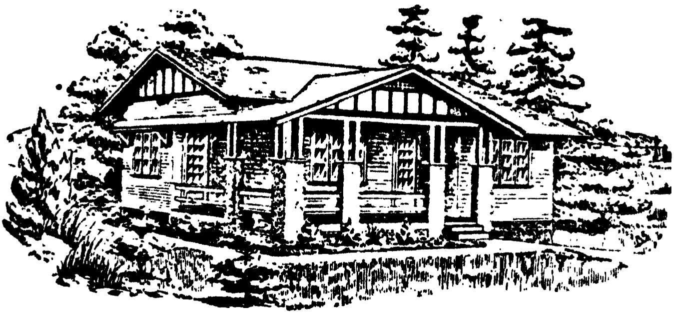

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	Maximum.		Minimum.				Maximum.		Minimum.				Maximum.		Minimum			
	Mean.	Highest.	Mean.	Lowest.	For Month.	Average.	Mean.	Highest.	Mean.	Lowest.	For Month.	Average.	Mean.	Highest.	Mean.	Lowest.	For Month.	Average.
	JUNE, 1929.						JULY, 1929.						AUGUST, 1929.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	65·8	74·6	47·5	37·4	6·43	4·08	63·8	68·8	43·2	37·8	1·89	4·06	65·5	79·0	45·9	38·6	1·90	2·71
Geraldton	68·0	78·5	53·6	44·8	7·88	4·70	65·6	69·0	50·5	39·3	3·20	3·91	67·7	78·0	52·0	43·4	1·56	2·90
Walebing	61·3	70·4	43·7	34·0	7·41	3·91	59·6	65·4	40·5	33·4	3·71	3·72	62·1	77·0	42·0	34·2	2·61	3·03
Perth	62·6	72·8	48·9	38·0	9·23	6·77	61·2	66·9	46·6	40·0	5·29	6·52	63·5	76·5	48·6	42·0	3·34	5·62
Kalamunda	63·3	73·0	48·2	38·0	11·79	7·92	60·5	66·0	44·6	40·0	4·70	8·30	62·9	76·0	44·9	39·0	4·15	6·99
Bunbury	62·0	68·2	47·0	34·5	11·39	7·13	61·0	66·2	44·9	34·2	4·44	6·98	62·5	72·0	46·4	36·0	3·00	5·40
Bridgetown	59·5	67·0	41·0	31·0	7·45	5·78	58·6	64·0	39·2	28·0	3·28	5·83	60·6	75·0	38·8	30·0	3·42	5·15
Albany	59·9	66·5	46·7	40·0	6·18	5·50	59·1	65·0	46·3	40·0	5·46	5·54	59·3	66·5	45·5	41·0	3·93	5·21
Merredin State Farm	59·1	70·0	43·6	32·6	3·09	1·78	57·6	62·7	39·6	30·2	1·19	1·94	61·0	73·8	40·9	33·9	0·94	1·40
Northam	62·1	70·1	41·4	33·0	4·77	3·25	60·4	65·0	40·0	32·0	3·49	3·46	63·7	75·1	41·3	31·8	1·54	2·57
York	61·4	69·0	42·6	32·0	4·48	3·30	59·9	65·0	39·4	30·0	2·40	3·41	63·1	75·0	40·6	34·0	1·69	2·82
Narrogin State Farm	57·9	64·6	41·9	32·3	4·38	3·62	56·8	61·5	39·9	30·5	1·93	4·20	59·1	71·4	39·7	33·8	2·01	3·26
Katanning	57·5	65·0	42·6	32·4	3·80	2·86	56·6	62·0	41·1	29·0	2·19	3·07	59·2	72·3	40·8	32·7	1·84	2·51
Cape Leeuwin ...	60·8	69·2	51·8	44·0	7·97	6·82	59·1	63·0	50·4	40·2	7·11	7·25	59·2	66·8	50·7	43·0	5·09	5·29

RED LEGGED EARTH MITE.

L. J. NEWMAN, F.E.S.,
Economic Entomologist.

The past season has witnessed a very severe and widespread outbreak of this pest. The early Autumn rains brought out the mites from the over-summering eggs, during mild humid weather, which proved favourable to their rapid increase, hence the plague which has been experienced. The unfortunate position is that the hatching of the mites synchronises with the germination of the clover seeds. Early out of season rains do not cause the eggs to hatch. It appears to be necessary not only for the land to become moist, but the relative humidity and moisture saturation of the atmosphere must take place before the aestivating or over-summering eggs will hatch. This condition normally occurs about mid-May. The newly-hatched mites at once turn their attention to the young clovers and weed seedlings. This constitutes a very serious check upon their growth, as the chlorophyll or green matter of the leaf is removed. Since plants manufacture their food supply largely in their leaves, any excess foliage injury, particularly when young, will greatly reduce their vitality and crop return, and if persisted in will ultimately cause death.

Unfortunately, little heed is taken of the presence of the initial Autumn outbreak. It is not until mid-June that the seriousness of the trouble becomes really apparent. By this time a Winter generation has been produced, the mite appearing in countless myriads. A general outcry when it is too late is then made as to what can be done to stem the trouble. The young clovers when badly attacked, instead of growing and producing early feed, turn yellow and in many instances die. Potato and pea crops are invaded and become stunted, anl likewise ruined. In the flower and vegetable gardens the seedlings are attacked and so checked that the plants, at best, make a most disappointing showing. Growers in general become disheartened and disappointed. In small areas methods of control can be satisfactorily applied.

The big issue, however, in regard to this pest is the very serious damage done by it to our pastures. Clovers have undoubtedly proved to be most adaptable to our South-West, Avon Valley and Great Southern areas. By means of these legumes, supplemented by top dressing with manure, the cattle and sheep carrying capacity of these lands has been greatly increased. Subterranean Clover of various strains has proved the most prolific to date. Clovers, unfortunately, are particularly subject to insect attack. Not only is the mite seriously injuring them, but also two other pests, namely the Lucerne Flea and the Clover Weevil.

I do not wish to be regarded as a pessimist, as I do not doubt that ways and means to cope with these troubles will be found. Facing facts as they are at present I fear that we are placing all our eggs in one basket, so to speak, when we rely upon clovers as our main pasture crop. Clovers will, no doubt, always play an important part in the stock-carrying capacity of our lands. The time has arrived, however, when the need for more effort to establish mixed pastures should be made. Clovers, which at present in many districts constitute 80 per cent. of the pasture, are not in themselves from a dietetic point of view a complete food ration, hence the need for growing other crops which are not relished by these pests.

Cereal crops are not seriously menaced. Oats are attacked but appear to outgrow the trouble. Wheat is practically immune from attack. Should the pest increase its attack upon cereals, it can be controlled by fallowing. The mite is particularly bad in the Avon Valley and Great Southern areas. The coastal country and the South-West are also infested, but in these districts its ravages have not generally been so disastrous, owing to the fact of the milder climate inducing a more rapid growth.

Several outbreaks have been recorded in the Wheat Belt. The pest generally orginates in the home garden, where it has been introduced per medium of seedlings or cuttings from infested gardens. The mite has a great variety of host plants, being most cosmopolitan in its tastes. This fact renders its control doubly hard. Cape weed, Chick weed and many others are prolific carriers of the pest. The incidence of this plant-feeding mite has entailed much work upon the Entomological Staff in studying its life history and habits. A great deal of time has also been devoted to devising ways and means for its prevention and treatment.

Prevention.—Having proved that the mite is carried over from late Spring to Autumn per medium of aestivating or over-summering eggs, the following advice is tendered. *The most important means of control is to place the land to be cropped the next Autum under clean fallow during the previous Spring.* Land to be so treated should be heavily stocked to eat down all feed present. This will enable the land to be ploughed with greater certainty of turning under completely all growth. The fallow must be kept free of any further growth until worked and resown the following Autumn. The land should be cultivated down to a good tilth with a compact sub-surface. *If the fallowing is done early enough, that is, before the dry weather sets in, there should not be any over-summering eggs present.* Allow at least two weeks to elapse after the first Autumn rains before harrowing and re-sowing the crop, which should be clovers and other approved pasture plants. This period after the rains will permit of any mite eggs that may be present to hatch in the impacted sub-surface soil, where they will die owing to being unable to reach the surface. If this method, which is recommended every third or fourth year, does not prove 100 per cent. effective, it will at least so check the pests that it will ensure the life of the pasture for a period of three or four years. By the end of this time it is quite possible the mite and other insect pests will have again increased to plague form, necessitating a repetition. The turning over of the land not only assists in the checking of the insects but also improves the growth and feeding value of the following crops.

Autumn Treatment.—If the land has not been placed under fallow the previous Spring a good check can be administered by thoroughly ploughing and turning in the young mites. These mites arise from the over-summering eggs and will hatch about two weeks after the first genuine Autumn rains. It is most important to take action, whether it be ploughing, dusting or spraying, to check this pest, before Winter eggs have been laid. The Winter eggs are laid upon the foliage. Infinitely better results will follow action taken then than later, when myriads of winter eggs have been deposited. Two weeks, therefore, after the first mites are observed, ploughing and other treatments should be undertaken. Ten days after preparing the land the crop can be sown. *As a further protection against invasion* from contiguous infested areas, keep a strip of cultivated land about 20 feet wide around the crop. The mites cannot readily pass over a loose buffer.

The fact that the mite floats in myriads on the surface of running water is a factor that has to be considered. A portion of land that has been treated as before described may be re-infested by the introduction of the mite from continguous infested areas by this means. It is, therefore, essential to see that any running water is diverted by means of drains from the land to be protected. *The use of forcing manures as the first top dressing of the pasture in the Autumn is advised.* This will assist the young seedling plants to grow rapidly and thus get ahead of the mite. If this growth can be maintained, then there is a good chance of the damage now suffered being greatly reduced. If the seedling plant growth is slow, the mites are able to destroy the leaves more rapidly than they are produced, hence many plants die, or their growth is so retarded that they are rendered useless as early winter feed. Later on, as the weather warms up in the Spring, they may eventually outgrow the attack. One of the principal objects of growing clovers, however, is to obtain early feed. *Never transfer seedling plants or cuttings from a mite infested area to a clean one.* This is one of the most prolific means of spreading the pest. It will always pay to raise one's own plants from seed. *Sheep are also spreaders of the mite.* The mites crawl on to the sheep whilst feeding or lying down. The sheep are then moved to another paddock or may even be transported some considerable distance. A fresh outbreak of mite is then established and hence by these means this wingless creature is spread.

Treatment.—During the past few years a great deal of experimental work against this pest has been done, with the view of finding the most economical means of combating it. The difficulty lies in the widespread nature of the trouble. Not only are the garden and useful pasture plants attacked, but all kinds of weeds are used as host plants. The question is one of economics. The cost of so many sprays and dusts that would effectively kill the mite render their use over large areas out of the question.

Over crops such as potatoes and vegetable home gardens, and limited pasture areas, the following sprays or dustings may be used:—

Phenyle.—1 part to 80 parts of water, sprayed on to the mites will destroy all those brought into contact.

Izal at the rate of one part to 250 parts of water will likewise act as a contact killer.

Black Leaf 40, 1 lb., soap, 3 lbs.; water, 70 gallons, is an effective spray. For small lots take one teaspoonful of Black Leaf 40, one ounce of soap to one gallon of water.

Kerosene and Naphthalene Emulsion is good. Kerosene two gallons; soap half a pound; Naphthalene half an ounce. Dissolve the Naphthalene in the kerosene, shred the soap and boil in one gallon of water. Remove from fire and add the kerosene-naphthalene, churning violently for 8 to 10 minutes. This will form an emulsion, which thickens on cooling. When using take one part of this stock to 8 parts of water.

As a dusting powder mix the following:—1 lb. of 15 per cent. Carbolic Powder; 4 lbs. Superphosphate or other finely ground manure. These are thoroughly mixed, giving a 3 per cent. carbolic content. Use as a top dressing at the rate of at least one cwt. per acre. The Carbolic powder may be used with lime, tobacco dust, or other suitable diluent. The advantage of

using the manure mixture is that it combines a fertiliser and mitecide: thus not only killing the mite but in the same act, and at the one cost for labour, manuring the crop.

A dusting for gardens can be made by taking the following:—Half a kerosene tin of lime and half a kerosene tin of tobacco dust. Thoroughly mix and add half a pint of kerosene. This is again mixed and allowed to stand overnight.

Burning Off.—If possible, the passing of a good fire over an infested area is advised. This will destroy the over-summering eggs. The burn must be a hot one, otherwise the effect will be only partial. The need for the conservation of fodder renders this method impossible in most cases. When eaten down as most pastures are, it is not possible to get a good running fire.

Biological Control.

Very little appears to be known of natural enemies of the mites. Every effort is being made to discover any predatory parasites. To this end communication has been opened up with entomologists in various parts of the world. Biological control may some day be successfully employed, but to date no effective parasite has been discovered. This mite has now established iteslf throughout the Commonwealth and is a national problem.

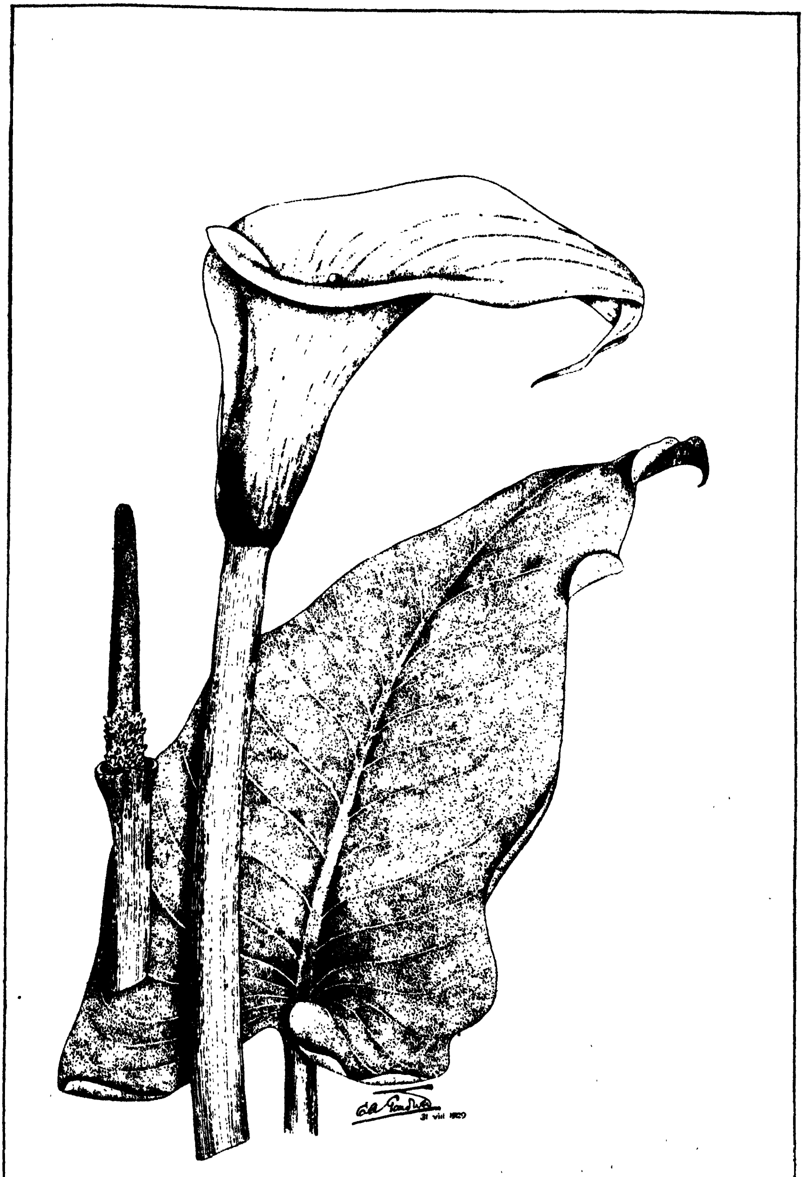
THE ARUM LILY.

(*Zantedeschia aethiopica*, Spreng.)

C. A. GARDNER,
Government Botanist.

The Arum Lily, familiar to most people as a much cultivated ornamental plant, has become naturalised in the wetter parts of Western Australia, finding a congenial environment in the black mud of several swamps in the older settled parts of the South-West, between Armadale and the Margaret River district. Especially is it abundant around the Vasse and Margaret Rivers, being in the spring, one of the features of the swampy areas. This plant is not a true lily, but belongs to the Arum family, and the so-called flower is not a flower, but a modified leaf or spathe which envelops a spadix or spike which contains many closely packed flowers of both sexes, the males being uppermost, the females below. Both flowers are destitute of corollas or perianths.

Originally native to South Africa, the Arum Lily has been introduced into many countries. In its native land it is known as the Pig Lily, and abroad is often spoken of as the "White Calla." In Western Australia it is stated that pigs feed on the rhizomes, but whether or not they are nutritious is a matter of doubt. Many plants of this family contain what is believed to be a saponin, a poisonous principle which acts as an irritant when in contact with the mucous membrane. This causes inflamation at the back of the mouth, and the tongue swells. Salivation follows, and diffi-



Arum Lily.

culty in swallowing is experienced. There is a case on record when a man in Perth, who accidently chewed part of the rhizome of this plant, was seriously ill for some time. Animals have been poisoned through eating species of *Arum*, a genus allied to *Zantedeschia*, but there are no authentic cases on record regarding our plant.

Description of Plant.

A perennial herbaceous plant with rhizomes. Leaves all basal, on long petioles, the blade cordate-ovate or sagittate-ovate, up to two feet in length. Peduncles exceeding the leaves, and appearing later than them, bearing a large white or creamy-white trumpet-shaped spate 5 to 10 inches long, with a broad limb and long recurved cusp; spadix yellow, shorter than the spathe, pistillate (*i.e.*, female) in the lower part, staminate (*i.e.*, male) in the upper part, containing numerous densely-packed flowers; stamens 2-3, free; ovary 1 or more celled, ovules usually 4 in each cell. Fruit berry-like, enclosed in the spathe. The plant is also known as *Richardia aethiopica*, or *Richardia africana*. The flowering season in Western Australia extends from August to December. Occasionally the plants have double spathes, and under cultivation, sometimes triple spathes.

This plant should not be encouraged in damp muddy soils, or in swampy localities. It may spread and choke out more valuable plants, such as white Dutch clover, Lotus or Paspalum. Eradication is difficult, but for small areas digging out is to be recommended.

HAND FEEDING OF SHEEP AT THE CHAPMAN EXPERIMENT FARM.

SUPPLEMENTS TO NATURAL SUMMER PASTURE.

F. L. SHIER, B.Sc.(Agric.),
Agricultural Adviser.

In order to study the effect of supplementing the dry natural pasture and stubble at the Chapman Experiment Farm, an experiment was conducted with a portion of the farm flock. Three even lots, each of 20 merino ewes mated to merino rams on the 1st November, 1927, were paddocked and fed as follows:—

Lot 1.—Dry pasture supplemented by a daily ration of ½ lb. whole oats, plus ½ lb. chaffed oaten and wheaten hay mixed.

Lot 2.—Dry pasture supplemented by ½ lb. of whole oats, plus 1½ lbs. of oaten and wheaten silage.

Lot 3.—Dry pasture only.

The dry pasture consisted mainly of wheaten and oaten stubble, together with a certain amount of Burr Trefoil and Cape Weed.

The silage was a mixture of unchaffed wheat and oat crops which had been cut at the hay stage, and pitted in a small trench silo during September, 1927. The trench was opened the last week in January, 1928, when the silage was found to be of good quality. Owing to the material being in the long state when ensiled, a certain amount of wastage occurred in the process of feeding it to the sheep. The amount of succulent silage given (1½ lbs.) was considered to approximate roughly the feeding value of the weight of the dry hay fed, viz., ½ lb. to Lot 2. On the 1st February, in

order that they should be under the same conditions as would obtain during the course of the experiment, the sheep were drafted out as follows:—

Lots 1 and 2 were confined in two small paddocks, each of three acres. The dry pasture consisted mainly of wheaten stubble, together with a certain amount of dry Burr Trefoil and Cape Weed. During the course of the experiment further supplies of wheaten hay were made available, but were not eaten by the sheep.

Lot 3 was placed in a 47-acre paddock containing wheaten and oaten stubble and a considerable amount of Burr Trefoil.

Throughout the experiment the sheep had access to a mineral lick, considerable quantities of which were consumed. The composition of the lick was as follows:—Coarse salt, 40 parts; slaked lime, 10 parts; superphosphate, 1 part.

A plentiful supply of good stock water was available in each paddock.

The experiment commenced on 14th February, the initial weighings being carried out on that date in the manner described in Bulletin 87 of this Department.

Lambing commenced during the second period between 12th March and 16th April, but the bulk of the lambs were dropped between 16th April and 28th May.

At the conclusion of the experiment the following lambs had been recorded.

Lot 1.—15 lambs, 3 of which were killed by crows.
Lot 2.—13 lambs, 5 of which were killed by crows.
Lot 3.—12 lambs, 3 of which were killed by crows.

Subsequent to the termination of the experiment, one lamb was dropped in Lot 1 and four in Lot 3.

The sheep were weighed on 12th March, 16th April, and the 20th May, the experiment being terminated on the last-mentioned date.

The weights recorded are given in the following tables:—

TABLE I.

SHEEP FEEDING EXPERIMENT.

No. 1 LOT.

Ration, ½lb. Chaff and ½lb. Oats daily per Sheep.

No. of Ear Tag.	1st weighing 14th Feb.	2nd weighting 12th Mar.	Loss or Gain after 1 month.	3rd weighing 16th April.	Loss or Gain after 2 months.	Last weighing 28th May.	Loss or Gain after 3 months.
135	84	90	+6	92	+8	91	+7
136	95	102	+7	104	+9	84	—11*
137	79	82	+3	84	+5	82	+3
138	98	99	+1	102	+4	98	*Nil*
139	101	109	+8	109	+8	93	—8*
140	99	107	+8	112	+13	92	—7*
141	90	106	+16	110	+20	96	+6*
142	110	113	+8	118	+8	92	—18*
143	95	101	+6	104	+9	90	—5*
144	100	111	+11	112	+12	101	+1*
145	107	112	+5	112	+5	109	+2
146	103	111	+8	117	+14	98	—5*
147	107	108	+1	111	+4	108	+1
148	101	111	+10	109	+8	98	—3*
149	104	111	+7	96	—8*	84	—20
150	112	125	+13	132	+20	95	—17*
151	117	122	+5	128	+11	112	—5*
152	92	104	+12	107	+15	94	+2*
153	96	101	+5	104	+8	86	—10*
154	92	103	+11	104	+12	80	—12*
Averages	99·10	106·40	+7·30	108·35	+9·25	94·15	4·95

* Denotes Ewes which had lambed since last weighing

TABLE 2.

SHEEP FEEDING EXPERIMENT.

No. 2 LOT.

Ration, ½lb. Oats and 1½lbs. Silage per day per Sheep.

No. of Ear Tag.	1st weighing 14th Feb.	2nd weighing 12th Mar.	Loss or Gain after 1 month.	3rd weighing 16th April.	Loss or Gain after 2 months.	4th weighing 28th May.	Loss or Gain after 3 months.
175	99	98	—1	102	+3	92	—7*
176	111	122	+11	122	+11	106	—5*
177	108	119	+11	120	+12	95	—13*
178	110	115	+5	115	+5	100	—10*
179	121	133	+12	122	+1*	112	—9
180	91	102	+11	101	+10	100	+9
181	108	118	+10	84	—24*	90	—18
182	104	107	+3	122	+18	86	—18*
183	106	112	+6	120	+14	127	+21
184	92	103	+11	101	+9	100	+8
185	122	130	+8	134	+12	112	—10*
186	108	118	+10	118	+10	98	—10*
187	98	114	+16	118	+20	94	—4*
188	95	102	+7	102	+7	102	+7
189	89	95	+6	96	+7	90	+1*
190	86	97	+11	98	+12	98	+12
191	77	85	+8	84	+7	85	+8
192	82	91	+9	98	+16	92	+10
193	76	79	+3	79	+3	78	+2
194	89	92	+3	75	—14*	66	—23
Averages	98·60	106·60	+8·00	105·55	+6·95	96·15	—2·45

* Denotes Ewes which had lambed since last weighing.

TABLE 3.

SHEEP FEEDING EXPERIMENT.

No. 3 LOT.

Ration—Natural Pasture.

No. of Ear Tag.	1st weighing 14th Feb.	2nd weighing 12th Mar.	Loss or Gain after 1 month.	3rd weighing 16th April.	Loss or Gain after 2 months.	Last weighing 28th May.	Loss or Gain after 3 months.
155	90	92	+2	100	+10	108	+18
156	106	109	+3	105	+9	120	+14
157	97	99	+2	114	+17	96	—1*
158	92	92	*Nil*	102	+10	84	—8*
159	120	117	—3	134	+14	106	—14*
160	104	104	*Nil*	108	+4	110	+6
161	94	96	+2	96	+2*	98	+4
162	103	107	+4	96	—7	91	—12
163	97	99	+2	105	+12	88	—9*
164	114	108	—6	118	+4	98	—16*
165	92	98	+6	108	+16	114	+22
166	97	100	+3	104	+7	104	+7
167	98	92	—6	105	+7	84	—14*
168	104	101	—3	101	—3	90	—14*
169	95	97	+2	108	+13	96	+1*
170	90	91	+1	106	+16	106	+16
171	87	87	*Nil*	90	+3	98	+11
172	83	75	—8	80	+3	92	+9
173	103	109	+6	120	+17	110	+7*
174	104	106	+2	108	+4	112	+8
Averages	98·50	98·95	+0·45	105·90	+7·40	100·25	+1·75

* Denotes Ewes which had lambed since last weighing.

The following table summarises the results shown in Tables 1, 2, and 3, and separates the ewes which did not lamb from the ewes which did.

TABLE 4.

Losses or gains of the Ewes which lambed and the Ewes which did not lamb during the course of the experiment.

	Lot 1.		Lot 2.		Lot 3.	
Date of weighing.	Ewes (15) which lambed during the experiment.	Ewes (5) which did not lamb.	Ewes (12) which lambed during the experiment.	Ewes (8) which did not lamb	Ewes (10) which lambed during the experiment.	Ewes (10) which did not lamb.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
12th March ...	+8·6	+3·2	+7·8	+8·3	—0·4	+1·3
16th April* ...	+10·6	+5·2	+5·1	+9·8	+8·9	+4·9
28th May ...	—7·5	+2·6†	—10·5	+9·7	—6·4	+9·9‡

* Prior to this date, one Ewe had lambed in Lot 1, three in Lot 2, and one in Lot 3. † One Ewe lambed subsequently. ‡ Four Ewes lambed subsequently.

Attention is drawn to the weights of the ewes from the first section of each lot, recorded on the 16th April, which had not lambed prior to this date. These are as follow:—

	Ewes not yet lambed.	Gain or Loss. lbs.
Lot 1	14 ..	+11.9
Lot 2	9 ..	+10.9
Lot 3	9 ..	+ 9.7

Conclusions.

1. Hand-fed ewes improved in weight earlier in the season than those receiving no supplement.

2. Ewes receiving supplementary feed, especially those receiving silage, lost in weight to a significantly greater amount at lambing than did those on natural pasture alone. This suggests that bigger and more vigorous lambs were produced on the supplemented diet, especially where silage was used as the supplement.

3. Dry ewes fed silage as a supplement made substantially greater gains than did those ewes receiving chaff as a supplement.

Note.—This comparison could not be extended to Lot 3, as four of these ewes lambed shortly after the termination of the experiment.

ONION WEED.

(Asphodelus fistulosus, *Linn.*)

C. A. GARDNER,
Government Botanist.

This is not one of the proclaimed noxious weeds, but is, notwithstanding, a serious weed in some parts of Western Australia. It is a perennial herbaceous plant of the Lily family, which has been naturalised for many years, coming originally from the Mediterranean region.

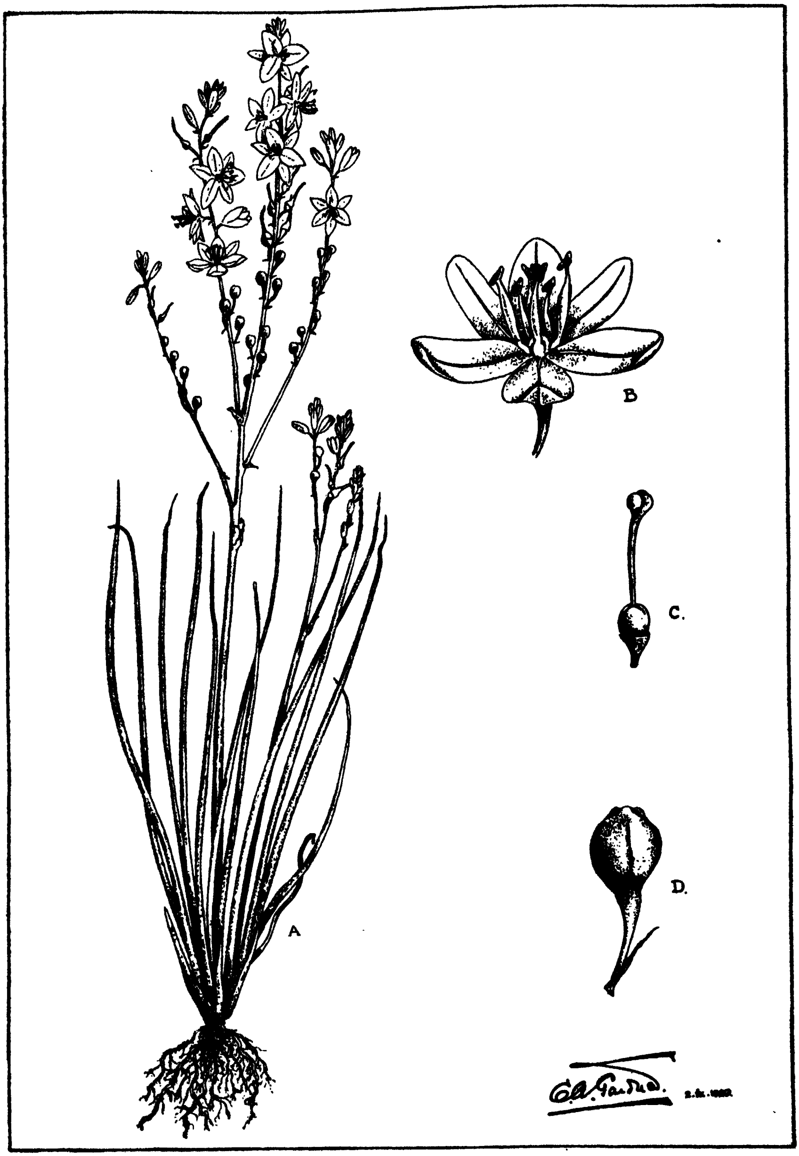
Description of Plant.

Roots long and fibrous, with no taproot; stem hollow, usually branching above. Leaves all radial, long, cylindrical, striate, hollow, more or less succulent; flower-buds pink, flowers white, with six divisions, all spreading, and with a purple central nerve, arranged in long racemes; pedicels jointed, with a narrow bract at the base; stamens six, inserted at the base of the segments, their broad papillose bases encircling the ovary, thickened above, the anthers opening inwards; style rather slender with a three-lobed stigma. Fruit a 3-celled capsule opening loculicidally by three valves which retain the partition down the middle, containing 3 to 6 triangular black wrinkled seeds. The flowering season is between July and November.

This plant is probably the Asphodel of classic literature.

Onion weed is not poisonous, but is disliked by stock. The ingestion of the plant by cows is said to impart an offensive odour and flavour to milk. Besides being perennial, the plant spreads by reason of the numerous seeds produced. In Western Australia it appears to favour limestone country, and is therefore common around Perth and Fremantle, the coastal country to the South, and the vicinity of Esperance. It is also common around Bunbury and on Rottnest Island. It appears to be spreading further inland from these old established areas, and tends to take possession of the land wherever it obtains a footing. Since stock rarely touch it, it is to be regarded as a serious weed where it occurs in pasture lands.

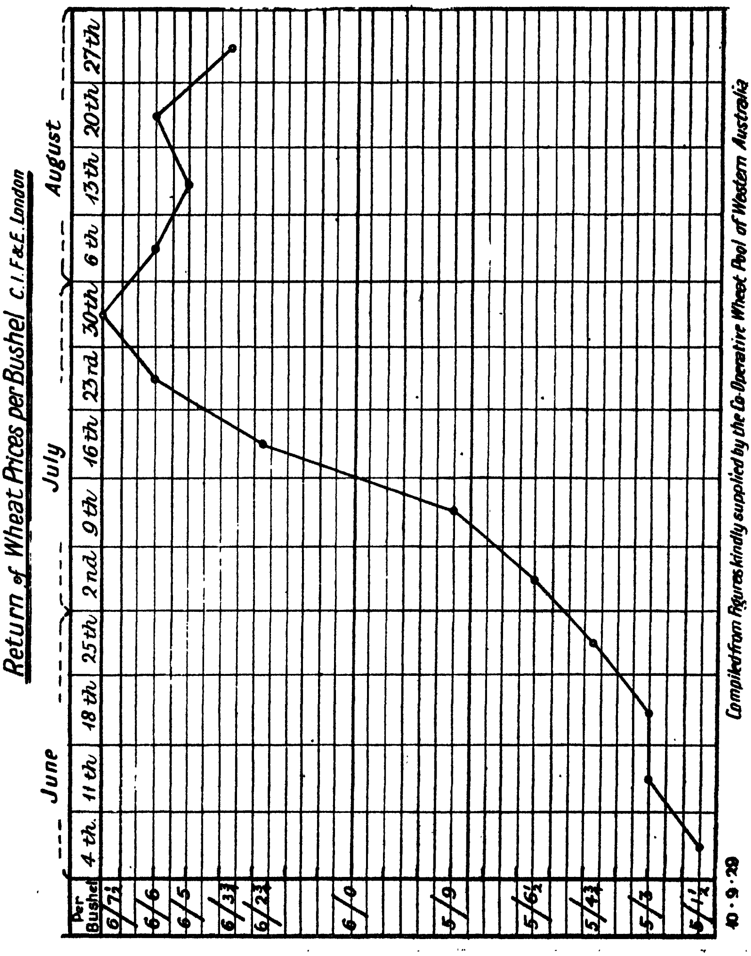
In eradicating Onion Weed it is important to commence operations when the plant commences to flower. At this stage hoeing or forking the plants from the soil is particularly fatal. Cultivation will suppress it, but the plants should be collected with care, since the plant is a succulent and may, therefore, live for several days after being uprooted, and re-establish its roots if left on the surface.



Onion Weed.

EXPLANATION OF PLATE.

A. Plant (½ natural size).
B. Flower (enlarged slightly).
C. Pistil.
D. Capsule.


Return of Wheat Prices per Bushel C.I.F.&E. London
June
July
August
Per Bushel
4 th.
11 th
18 th
25 th
2 nd
9 th
16 th
23 rd
30th
6 th
13 th
20 th
27 th
6/7½
6/6
6/5
6/3¾
6/2¾
6/0
5/9
5/6½
5/4¾
5/3
5/1½
10·9·29
Compiled from Figures kindly supplied by the Co-Operative Wheat Pool of Western Australia

PRODUCERS' MARKETS, LTD.

REPORT FOR QUARTER ENDING AUGUST 31st, 1929.

Fruit for the months ending August 31st was well supplied with all varieties in season. In the early part only moderate supplies of tomatoes ex Geraldton came forward; they have since increased in volume and eased in price. All lines of navels have improved in value although last year's prices were not obtained, owing to much larger quantities being placed on the market this year. Oranges (plain) have also improved and realised up to 11s. for ¾-bushel cases, but the best quality has yet to come forward. All lines of sweet mandarins sold very satisfactorily throughout. Lemons have been very unsettled owing to weather conditions; during the month we realised up to 12s. 6d. ¾ cases for prime lines.

From the beginning of the month there has been a rapid improvement in prices for all prime lines of apples, the demand for prime Yates being greater than the supply—realising from 19s. to 23s. 9d.; Granny Smiths up to 21s. 9d. next in demand. All prime lines of Delicious met competition up to 21s. 6d.; these must be nicely coloured to realise good prices. Prime Dunn's Seedlings are getting scarce, also Cleopatras; Statesmen, Stewarts, Jonathans, and all other varieties 2½in. upward have realised very satisfactory prices.

Only a moderate supply of pears has come forward. Ex cool store up to 13s. for ¾-bushel cases. Supplies of cape gooseberries are below the demand, and are realising good values. Passion fruit increase in volume, easing slightly. There is only a medium supply of grapefruit which realised high prices up to 22s. 6d. for ¾ cases.

Vegetables.—At the beginning of the period heavy vegetable supplies were marketed.

Cauliflowers were over supplied, and while prime lines sold at fair values inferior lines were heavy and unsaleable. Cabbage values suffered in consequence.

Bunch lines were in keen demand, beetroot and lettuce touching very high prices. Potato lines were short and values firmed. Peas and beans of the first crop made their appearance and realised high prices. In July changes as to quantity and quality were noticeable. Bunch lines increased in volume and prices came down to their normal value. Cauliflower supplies eased to an improvement in values, and cabbage firmed accordingly. Peas and beans remained firm, and potatoes were short with values rising. Pumpkins were steady and only prime swedes were in demand.

In the last month of the period bunch lines remained steady. The second crop of cauliflowers caused values to ease with this variety. Potatoes were very short and values very firm, as high as as 40s. per cwt. being paid for prime quality. Peas increased in volume, supplies forward mainly from the Geraldton district. Pumpkins and swedes were steady. Briefly, supplies have been steady and values satisfactory throughout.

Poultry.—Early in June good supplies of poultry came forward, with high values ruling for all prime lines. The volume increased towards the middle of the month so that the value of turkeys receded slightly and im-

proved towards the end, while Muscovies were well supplied. By the end of June these were realising 13s. to 14s. 6d., and turkey gobblers from 35s. to 41s. The market fluctuated during July with a very keen demand for prime cockerels, Muscovy drakes and heavy hens. Turkeys eased slightly and sold at 30s. to 35s. Young chickens came forward much earlier than usual, and we were able to offer reliable lines to country buyers. During mid-July the demand became somewhat weaker in comparison with the heavy supply, though heavy turkeys were in excellent demand, and at the end of July supplies were not equal to the demand. In August there was a keen demand and a good supply coming forward. Good turkeys realised 39s. 6d. to 45s., while prime Muscovy drakes brought from 14s. 9d. to 15s. 9d., and Muscovy ducks 8s. 6d. to 10s. 6d. All through the month the supply of poultry was plentiful to a keen demand.

Eggs.—The egg supply began to increase at the beginning of the quarter, and prices ranged from 2s. 4d. to 2s. 7d. for new-laid metropolitan. Duck eggs realised 2s. $1\frac{1}{2}$d. to 2s. 4d. The heavy demand at the end of June kept prices to 2s. $1\frac{1}{2}$d. for guaranteed new-laid. During July supplies increased to a falling market, and new-laid only realised 1s. $8\frac{1}{2}$d. to 1s. $11\frac{1}{2}$d., and by the end of the month they were only realising 1s. 6d. for metropolitan, and country new-laid were 1s. 4d. to 1s. 6d., and clients were urged to pack for export.

Eggs intended for export should weigh from $1\frac{7}{8}$ oz. to $2\frac{1}{8}$ oz., and should be clean and sound in shell. An egg-cleaning machine has been installed, and it is hoped that this will facilitate the export of our surplus eggs. Large quantities were being pulped towards the end of August, and growers were strongly urged to pack 1st grade eggs for export. A shipment of eggs left for London during the month.

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder Smith & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK YARDED AT METROPOLITAN FAT STOCK MARKETS, JUNE, JULY, AUGUST, 1929.

—	June.				July.					August.			
	5th	12th	19th	26th	3rd	10th	17th	24th	31st	7th	14th	21st	28th
Sheep and Lambs	7,339	9,425	10,330	10,845	10,538	11,884	12,833	8,850	9,781	10,228	11,847	13,964	14,596
Cattle ...	446	597	673	703	541	808	860	757	*874	907	810	805	830
Pigs ...	544	450	488	707	437	566	478	394	521	572	682	630	795

* 378 stores.

COMPARATIVE VALUES PER POUND OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS DURING JUNE, JULY, AUGUST, 1929.

—	June.				July.					August.			
	5th.	12th	19th	26th	3rd	10th	17th	24th	31st	7th	14th	21st	28th
Mutton ...	11½	11½	11	10½	9¾	8½	8½	9	9	9½	9¼	9¼	7½
Beef ...	8½	7½	7½	8	8½	7½	6½	6¾	7¼	6¾	6½	6	5½
Pork ...	13¼	13¼	13¼	12½	12½	12¼	12¼	12	11½	11½	11	10½	10½
Bacon ...	10½	10½	10½	10½	10½	10½	10	10	10	9¾	9¾	9½	9½

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth, have supplied us with the following information regarding Chaff available at the Metropolitan Chaff and Grain Auction Sales, held in Perth for the period of June to August (inclusive). In all cases the prices quoted are for F.a.q. to Prime Wheaten Chaff packed in new bags.

Wheaten Chaff.—Supplies arriving during June were rather more than ample to meet requirements and values greatly declined. F.a.q. to Prime, at the latter part of the month, being £5 10s. 0d. per ton. This price did not show any inducement to holders to market and with small yardings the value showed a set improvement, the following being closing quotations.

Quantity	Maximum	Minimum.
750 tons	£6 0 0	£5 5 0

July.—Supplies of Chaff arriving were sufficient to meet the demand and the market was steady.

Quantity	Maximum	Minimum.
850 tons	£6 10 0	£5 15 0

At the beginning of August, supplies arriving were rather short, there being an enquiry from the Eastern States, a considerable quantity being shipped, which had a tendency of firming the market to £6 12s. 6d. per ton. Rain was experienced in the Eastern States and enquiries consequently ceased, with a proportion being cancelled and we again experienced heavy yardings at the latter part of this month, when the market eased to £5 15s. 0d.

Quantity	Maximum	Minimum.
950 tons	£6 12 6	£5 15 0

Oaten Chaff.—Consignments throughout the period under review have not been heavy, but the demand has been far from bright, and the prices have fluctuated more or less in sympathy with the price of Wheaten, F.a.q. being worth from £5 7s. 6d. to £5 10s. 0d. per ton, Medium qualities selling at from £5 0s. 0d. to £5 5s. 0d. per ton. During the latter part of August, the market eased, F.a.q. selling at £5 5s. 0d. to £5 7s. 6d. and Medium qualities at £4 10s. 0d. to £4 15s. 0d. per ton.

Oats.—Good supplies have been finding their way to market and with rather a poor demand values eased somewhat and good heavy feed Algerian and Guyras realised from 2s. 7d. to 2s. 7½d. per bushel. Exceptional quality up to 2s. 9d. per bushel and medium feed at 2s. 5½d. to 2s. 6d. per bushel, light feeds at from 2s. to 2s. 3d. per bushel.

Wheat.—During the month of June, after the seeding was completed, good supplies of surplus seed were arriving, F.a.q. realising 4s. 3d. per bushel and quality approaching this at 4s. 2d. per bushel. Drought conditions at a critical period in Canada have been largely responsible for the sharp rise that has taken place in the World's market. Whereas a few weeks ago, Wheat was difficult to dispose of at lower figures, we are pleased to report that this market has firmed considerably, F.a.q. realising from 5s. 3d. to 5s. 5d. per bushel, with an occasional truck of prime milling quality at 5s. 6d. per bushel, smutty and inferior at lower rates according to sample.

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WESTERN AUSTRALIA.

Vol. 6. (Second Series) DECEMBER, 1929. No. 4.

FROM WOOL TO LAMBS.

(EDITOR.)

When the price of a nation's principal export product tumbles 20 per cent. it is a serious happening, but when that nation supplies 25 per cent. of the world's requirements of the commodity, and it represents 42 per cent. of the total exports of the nation, then the matter borders on the alarming. Yet that has happened in the case of Australia's wool-growing industry, if we compare the peak year of the past decade, 1924-25, with the 1927-8 season. The average values of wool, per lb., exported in the years first mentioned were for greasy 27.10d. and scoured 39.81d., while in 1927-8 they fell to 20.48d. and 31.87d. respectively. The estimated figures for the 1928-9 season offer neither consolation nor re-assurance, indication being that they will average still less when the year's operations are accounted. It is true that during the past decade we have participated in very substantial returns for our staple product, although these good prices do not constitute anything in the nature of a record. There have been some very handsome individual prices obtained in earlier times. The pioneer of Australian studmasters, Captain John McArthur, is said to have received 196d. per lb. for a single bale of his wool, and according to the Commonwealth Official Year Book there is a record of 136d. per lb. having been obtained as late as 1920. But such exceptional prices as these have no true bearing on the national value of the industry. In later years the highest price given for Australian greasy wool is stated as 53¼d. per lb., and it seems that present buyers are only prepared to offer a lamentably reduced figure.

It would be idle speculation to attempt a forecast of what the near future holds for the wool grower, but undue pessimism is quite unwarranted. It has been contended that the high prices ruling during abnormal years

have driven manufacturers to seek refuge in substitutes, and that pure wool will not again return to its former popularity. However, it may be accepted as a general rule that the fashion burgeons from the world's parity value of any commodity, and wool is too useful a produce to be easily displaced from the looms, provided it can be produced at a reasonable cost. From the farmer's viewpoint it will be found no more than sane economy to regulate his production in such a way as will best tend to stabilise the market and bring a fair return for his labour. It is an unwise and unnecessary risk to carry all your eggs in one basket, is a proverb that retains its applicability.

Let it be faced that there is at present a serious and substantial decline in the price of wool, and to the farmer producing it in conjunction with other goods, this decline is likely to make an appreciable difference to his sources of income. It behoves him, therefore, to give some thought to methods of improving his position. Fortunately he is more favourably situated than the pastoralist, because in many instances he can convert from wool to lambs without very serious inconvenience. It will involve a change that calls for no drastic measures, and with a recovery of the wool market the change over will have brought about no complications entailing a struggle to get back to the former lines of breeding. Many farmers are already serious in their consideration of this point, and it is almost certain that within a comparatively short space of time there will be a notable transformation from wool production to fat lambs.

Quite apart from the aspect of wool values, which are liable to fluctuation, it is inevitable that we must seek to build up an export lamb trade, for our flocks already exceed nine millions in this State alone, and their progeny must become far in excess of the demand for local consumption. Those who, from necessity or choice, enter upon the business of raising lambs for market will, if they are wise, aim at producing lambs that will best comply with the import market requirements and consequently bring in the best returns. To help towards this end it was opportune that the authorities at the Department of Agriculture decided upon a conference for the discussion of a policy for adoption. Mr. E. H. B. Lefroy, of Cranmore Park, Walebing, was invited to join the discussion, and with the Director of Agriculture (Mr. G. L. Sutton), the Sheep and Wool Inspector (Mr. Hugh McCallum), and the Superintendent of Wheat Farms (Mr. I. Thomas) held a meeting on the 13th November. As a result of their deliberations the following conclusions were reached as a basis on which advice would be tendered to farmers on the matter of raising lambs for market:—

(1) That the most suitable fat lamb would be produced as the result of mating a Southdown, Shropshire or Dorset Horn ram with a crossbred ewe.

(2) That the most suitable crossbred ewe for the purpose would be produced as the result of mating good type merino ewes with a Border Leicester, English Leicester, or Lincoln ram, or where foot-rot is troublesome, with a Romney Marsh.

These latter conclusions, based on South Australian and New South Wales experiments, have been accepted as sufficiently definite without further trial. It is, however, considered advisable to conduct experiments with the Southdown, Shropshire and Dorset Horn rams mated with the Border Leicester-Merino ewes, in order to establish their relative suitability under local conditions, and it was decided to carry out these experiments on the Avondale farm.

Having regard also to the desirability of building up a simple sheep husbandry on the farm, it was further decided to recommend the farmer to confine his attention to one phase of sheep-breeding only, and thus avoid the necessity for keeping more than one breed of ram.

Dividing this branch of agriculture into two principal features, it was agreed that—

(a) For the production of wool the farmer thus engaged should keep merino rams only, and mate with merino ewes.

(b) For the production of crossbred mothers for fat lamb raising he should use long-wooled British rams only, and of the following breeds: Border Leicester, English Leicester, Lincoln (or Romney Marsh) rams, and mate them with good merino ewes.

(c) For the production of fat lambs for export or local market short-wooled British rams only should be used, and only rams belonging to one of the following breeds should be kept:—Southdown, Shropshire, or Dorset Horn.

Departmental policy favours a consultative committee to deal with the projects under investigation, and Mr. Lefroy was asked, and has consented, to act in conjunction with the remaining personnel of the conference, and the result of their experiment and experience will be watched with interest.

As merino ewes are necessarily the basis upon which the export lamb industry will be built up, it is opportune to again remind farmers, whose function it will be to raise these ewes, of the departmental policy for the care and improvement of merino flocks, which has been consistently advocated by the Sheep and Wool Inspector and advisers on the staff of the Department of Agriculture. The important point to remember is that the improvements will be brought about in the first place by the use of pure bred rams of the type and strain most nearly approaching the ideal the farmer has in mind, and the continued use of the same type and strain from established pure studs to achieve and maintain the purity of the type. There must be a constant and systematic culling of inferior and aged animals, and proper care of the flock throughout the year, which involves ample provision of fresh, clear water, the supplementation of pastures where this is necessary, and strict attention to keeping the animals free from parasites.

There has been practically no export of lamb from this State since 1924, with the exception of some consignments totalling 6,685 carcases dur-

ing the 1927-8 season. This has been due in a great measure to the buoyancy of the wool market as well as the local consumption of the food. The Australian likes his mutton, and in comparison with the people of other countries he eats it with avidity. It has been calculated that the consumption of lamb and mutton in Australia is to population approximately 61 lbs. per head per annum, as against 27 lbs. in the United Kingdom, 6 lbs. in Canada, and 5½ lbs. in the United States of America. It must be borne in mind, however, that in other countries the people are not so favoured with opportunities of obtaining this article of diet, and there is, generally speaking, a good market for fat lambs.

Despite the Australian's addiction to this delicacy, the rapid increase of our flocks, our huge areas of pastoral country, our wonderful climate and the paucity of our population makes an export trade a necessity. The demand for lambs in the great Smithfield markets evidences a marked preference for New Zealand Canterbury lambs as against other importations. Latest quotations are given as 8¾d. per lb. light (28 to 36 lbs.), with their nearest rival, Victorian lambs of the same class, quoted ½d. per lb. lower. The demand for Canterbury lambs, however, is not the creation of a season, and the enviable reputation of the New Zealand grower has to be "gone after," and will take some pursuit. Such preferences are only achieved by begetting a confidence in the goods delivered, and that confidence can only be inspired through experience of past excellence and a knowledge of the bona fides of the grower. Breeding of lambs is not, therefore, the beginning and the end of the business, and handling and dressing are important phases in the delivery of a good carcase. "Tender as a lamb" is not an imaginative expression, but based on actual fact. In discussing this with a prominent authority connected with one of the largest firms operating in Australasia the writer was astonished at instances given where careless handling blemished and spoiled until a first-class lamb was reduced to a reject. An over zealous sheep dog or the intervention of a too-hasty trucker can literally cut shillings out of the consignor's lamb, and if applied to his consignment may easily cause a big subtraction from the anticipated cheque. But these considerations may be left for the time being. Breeding of the right class of lamb is the first step in the direction to be travelled, and the advice and experiment of those who have undertaken investigation for the farmers' benefit should be closely followed.

THE FERTILISERS ACT, 1928.

N. DAVENPORT, B.Sc. (Agric.),
Inspector of Fertilisers.

Owing to the increased sale of Fertilisers in this State, the improved methods of manufacture, and a more varied and exacting demand by our agriculturists, it was evident that the Fertilisers and Feeding Stuffs Act of 1904 had become inadequate for its purpose.

When revising this Act, in order to meet present demands, it was decided to separate the two phases, and the result of this division was that separate Acts, dealing with Fertilisers and Feeding Stuffs respectively, were placed before Parliament. The former was assented to on 15th November, 1928. It contained provision for its proclamation upon a day to be fixed, which was decided upon as 1st November of this year, this being the commencement of the official fertiliser year.

In this Act particular attention has been given to the definition of terms, many of which did not occur in the previous Act, while those which are common to both have, in most cases, been treated more explicitly.

The additional definitions include the following:—

"Bone dust" or "Bone meal." This must consist solely of disintegrated bones, as no admixture of any nature is permitted.

"Bone Fertiliser" or "Bone Manure." This provides for the manufacture of mixed manures of a total or partial organic nature, in which the phosphoric acid may be supplied only from bones and superphosphate.

"Fine material." Various grades of Fine Material are specified for different manures. This is a general term, meaning particles smaller than the prescribed size in each particular case.

"Grade Formula" provides for a concise description where it is desired to emphasise the percentage contents of the fertilising ingredients in a fertiliser (provision being made for nitrogen, phosphoric acid, and potash), or where, especially in the case of mixed manures, the composite name representing the mixture would be too cumbersome. The order in which the fertilising ingredients may be represented by integral figures denoting the percentage is nitrogen, phosphoric acid, potash. Thus, a fertiliser, numbered 3:15:6 would mean that it contained 3 per cent. of nitrogen, 15 per cent. of total phosphoric acid, and 6 per cent. of potash.

"Gypsum" has been defined owing to the wider use of this fertiliser and because of specific reference to it in the present Act.

"Lime" has also been defined, as it was found necessary to differentiate between "caustic lime" and "agricultural lime," the latter being in the form of slaked lime or of the carbonate in either the natural or artificial form.

"Phosphate Fertiliser" is the term provided for the description of fertilisers which contain Phosphoric Acid, but do not conform to the standards for bone dust, bone meal, bone fertiliser, or bone manure.

"To buy" and "to sell" are also treated exhaustively for the purposes of the Act.

The various combinations of phosphoric acid with respect to its solubility are described as those which are determined by particular processes of analysis.

"Fertiliser" is defined in a more particular manner with respect to special fertilising ingredients making certain exceptions and providing for the proclamation of material which is not considered as a fertiliser for the purposes of the Act.

As this Act has been introduced with the main object of protecting the consumer, it is provided that it is not applicable to the sale of bulk lots of fertilising compounds to a fertilising manufacturer, or to the sale of quantities less than one hundredweight. In the latter case, however, it is necessary that the fertiliser shall be registered, and that each package shall be conspicuously marked with a copy of the registered brand and the name of the fertiliser.

Application for registration must be made prior to 1st November of each year, as on that date all previous registrations are cancelled. The information required for registration has been increased, one of the objects being the computation of unit values for the different fertilising ingredients.

The publication of a list of dealers, registered fertilisers, and particulars of registration may be made in the *Government Gazette* or this *Journal of Agriculture*, as soon after the commencement of each fertiliser year as is possible, *i.e.*, as soon as registrations are complete for the moment.

In order to ensure that the material demanded and paid for is supplied, it is incumbent upon the seller to issue an invoice with each sale, provided that the quantity sold is one hundredweight or more. On this invoice shall be stated the name and business address of the seller and of the manufacturer, if the fertiliser is manufactured within the State; a copy of the registered brand and name of the fertiliser; the minimum percentages of the fertilising ingredients and the forms in which they occur in the fertiliser, and other particulars such as fineness, percentage of calcium as calcium oxide, and gypsum when these are applicable.

Owing to the difficult nature of keeping the fertilising ingredients of a manure exactly to the registered percentages, limits of variation are set for the respective constituents. These are:—

For	nitrogen	.5	per cent.
„	total phosphoric acid P_2O_5	1.5	„
„	water soluble phosphoric acid P_2O_5	.5	„
„	citrate soluble phosphoric acid P_2O_5	.5	„
„	acid soluble phosphoric acid P_2O_5	.5	„
„	potash K_2O	.5	„
„	lime	7.0	„
„	fine material	5.0	„

This means that if deficiencies occur greater than those in the above table, then the seller is liable to prosecution.

In the case of fertilisers containing phosphoric acid, however, an excess of water or citrate soluble phosphoric acid may be offset against a deficiency of acid soluble phosphoric acid, also an excess of one of the water soluble or citrate soluble forms may be offset against a deficiency of the other.

In the case of bone dust and bone meal also, natural variations make it difficult to keep to a definite standard for both nitrogen and phosphoric acid, and provision is made here also for the offsetting in proportion of an excess of one ingredient with the other, or *vice versa*.

Provision is made for the prevention of admixture of mineral substances such as superphosphate and gypsum with bone fertiliser or bone manure

advertised as such and also of the suggestion of bone manure in material which is being sold as phosphate fertiliser, which according to the definition contains no bone manure.

Inspectors will be appointed and analysts will be licensed by the Governor in order to administer the Act.

For the purpose of taking samples of fertilisers inspectors may enter any place where these are, or may reasonably be supposed to be, kept for sale or sold. Samples may also be taken of any fertilisers in transit.

The sample taken is divided into three. One is given to the seller or his agent, one is given to an analyst for analysis, and the remaining sample is kept as a referee, to be analysed if a dispute occurs.

The result of analysis is sent to the vendor or his agent and may be published in the *Gazette* or any newspaper and in such other manner as is prescribed.

Provision has been made in the Act for the prescribing of particulars under many of the sections, to which effect was given by the publishing of a set of regulations in the *Government Gazette* of 25th October, 1929.

Under Section 12 of the Act certain manures are prescibed to which degrees of fineness are applicable.

These have been given in the regulations and are as follow:—

(a) Bone dust, bone meal, bone fertiliser, bone manure and blood and bone, at least 95 per cent. of which will pass a sieve with circular holes 3/16in. diameter, and at least 65 per cent. pass a sieve of 20 meshes per linear inch.

(b) Basic slag and Thomas' phosphate, at least 95 per cent. of which must pass a sieve of 30 meshes to the linear inch and at least 80 per cent. pass a sieve of 90 meshes to the linear inch.

(c) Ground limestone and lime sand shall be of such fineness that 80 per cent. will pass a sieve of 20 meshes to the linear inch.

In order to prevent the sale of fertilisers which are not of a reasonably high manurial standard, minimum limit of fertilising ingredients have been fixed for the following:—

Basic slag or Thomas' phosphate.
Bone dust or bone meal.
Blood and bone.
Superphosphate.
Ground limestone and lime sand.
Gypsum.

The regulations also stipulate the proportion of phosphoric acid in excess in bone dust, bone meal, and blood and bone, which may be offset against a deficiency of nitrogen or *vice versa*, and this paragraph reads as follows:—

"Any deficiency of nitrogen may be considered as compensated for by an excess of phosphoric acid (P_2O_5) not less than four times the deficiency of nitrogen and any deficiency of phosphoric acid by an excess of nitrogen not less than one-fourth the deficiency of phosphoric acid."

A detailed method of sampling is included, together with the method of analysis for the different fertilising ingredients which come within the province of the Act.

The first schedule is composed of a set of forms for the following purposes:—

Application for registration of fertiliser.
Application for amendment of registration of fertiliser.
Invoice to be supplied on sale of fertiliser.
Certificate of Analysis.
Record of sample and its description received by the Analyst from an Inspector.
Notification of result of analysis to vendor.

The second schedule deals with the fees payable under the Act, and are as follow:—

Fees for Registration, etc.

	£	s.	d.
For 20 fertilisers or under	5	0	0
For every additional fertiliser	0	5	0
For the inspection of the register	0	2	6
For a certified copy of each entry	0	2	6
Amendment of percentage	0	2	6

Fees for Analysis.

	Scale A.	Scale B.
For the determination of any one constituent ..	15s.	5s.
For the complete analysis of a fertiliser having four or more fertilising constituents ..	60s.	20s.

Scale B shall apply only to *bona fide* graziers, farmers, or market gardeners.

Scale A shall apply to all other applicants for an analysis.

"THE JOURNAL OF AGRICULTURE"

will be supplied free *on application* to any person in the State who is following Agricultural, Horticultural, or Viticultural pursuits, to Agricultural Societies or Associations, and to any person otherwise interested in Agriculture.

A charge of Threepence per copy will be made for the *Journal* to persons other than the foregoing, or who do not reside in the State. These applications accompanied by the requisite amount, must be forwarded to the Director of Agriculture, Department of Agriculture, who will also receive all correspondence dealing with the conduct of the *Journal*.

Editors of agricultural and country papers are invited to reproduce any of the articles contained in this *Journal*, providing the usual acknowledgment is made.

If you are not receiving the *Journal*, which is issued quarterly, and wish to do so, please forward your name and postal address to the Director of Agriculture, Perth.

HONEY.

H. WILLOUGHBY LANCE,
Apiculturist.

The last few years have made many changes in the eating habits of most people. Many patent foods have been introduced, and scientists have been stressing the value of carbohydrates, proteins, vitamins, etc. Other schools, particularly in America, have been teaching physical culture, combined with careful study of diet, as the surest way to health.

There is little doubt that primitive man, with his open air life—plenty of exercise and living on the products of the land—passed a more healthy existence than the town dweller of to-day. The value of fruit, vegetables, and honey—the original and simple forms of food provided for man—are gradually being realised. To many, however, fruit and honey are still considered as extras instead of staple articles of diet. Fresh fruit and vegetables can only be obtained at certain seasons of the year; but honey can be obtained all the year round, as it will keep good indefinitely, and should always be in the larder and on the table with the bread and the butter.

Honey, as we all know, was up to the sixteenth century practically the only food-sweet known; then sugar was introduced, and on account of its cheapness and the ease with which it could be handled, almost ousted honey from the diet of civilised man. Sugar, however, cannot take the place of honey in dietary value. It requires the aid of the juices of the stomach to digest it and to enable it to be assimilated by the body. Honey is the nectar of the flowers, already digested by the bees, and is easily assimilated without the aid of other substances or juices.

When the field bee has gathered her load of nectar, she carries it home to the hive in her honey sack. Here she passes it on to another and younger bee, who deposits it in the cells, where it is ripened. While these bees are carrying the nectar it is presumed that some chemicals are added to it, and that some of the water is evaporated, then after being placed in the cell further water is evaporated by the heat of the hive and ripened until it becomes honey as we know it.

The principal constituents of honey is of course sugar, but of a different character to cane sugar and belongs to the class of "inverted" sugars. When light is passed through "inverted" sugar, the light is deflected to the left instead of the right as with ordinary sugar. Inverting is part of the chemistry of digestion and takes energy from the body. Honey, being already inverted, is immediately absorbed by the system, and the energy, which would have been used, is saved for other purposes. Honey is a carbohydrate food and produces energy and vitality; and as a food for a man doing hard physical work cannot be beaten. It is, however, more than an energy food, as it contains small quantities of proteins by means of pollen grains which get into the honey during gathering and extracting, and these proteins assist in building up the tissues.

Mineral salts are also contained in honey, the principal being phosphorous and iron. The dark honeys usually contain more of these latter than the light. In many countries there is a prejudice in favour of light honey; this usually has a milder flavour, which some people prefer. It should, there-

fore, be remembered that dark honey is usually better for the system, and people should accustom themselves to the use of this.

I have recently had some of our local honeys analysed by the Government Analyst with the result shown below:—

——	Taylorina.	Powder Bark Wandoo.	Tuart.	Dark Coastal.
	%	%	%	%
Water	17·28	17·42	18·83	17·36
Protein (N x 6·25)	0·23	0·13	0·31	0·36
Fat (wax)	·02	·04	·06	·06
Sugar	82·34	81·88	80·07	81·46
Ash	·13	·53	·73	·76
	100·00	100·00	100·00	100·00
The ash contained phosphorus	·004	·002	·006	·007
Equivalent to phosphoric anhydride	·009	·005	·015	·017
Iron	·0007	·0010	·0005	·0016

The Taylorina (*Psoralia pinnata*) is a very light honey obtained from a bush growing in the Albany district, originally imported from South Africa.

Powder Bark Wandoo is very similar to the ordinary White Gum Wandoo. Both of these are very light honeys.

Tuart is a large eucalypt growing along a strip of coast country from Busselton to about Wanneroo.

Coastal dark is obtained from a variety of trees and bushes and cannot be identified with any particular tree or bush. Both of these latter honeys are dark.

It will be noted that the lightest of our West Australian honeys is the richest in sugar but second lowest in both phosphorus and iron.

The Power Bark Wandoo, a slightly darker honey, comes second with 81.88 per cent sugar, lowest in phosphorus, but second highest in iron.

Tuart shows highest in water, lowest in sugar, and highest in phosphorus.

Coastal, which is a honey obtained along our coastal districts at certain seasons of the year, more particularly in the spring, is a natural blend from a variety of sources, and varies from time to time. It will be noted that this honey is richest in proteins, phosphorus and iron, with only a little more water than Taylorina. As regards water, it must be remembered that this will vary in different seasons and from time to time while the nectar is being gathered, depending upon the humidity of the atmosphere and the time taken by the bees to ripen the honey.

As regards colour, this is no real criterion of the value of honey, but the colour of many of our rich dark honeys is due to the presence of both tannin and iron and is an almost sure indication of the presence of iron. What is meant when one speaks of the colour of honey is that if a beam of pure white

light is passed through honey, some of its constituents will be absorbed by the honey while others will pass through. When we speak of honey as "amber" we mean that the combination of wave lengths of light which affect the human retina and have passed through the honey are such as to give the effect of what we term "amber," while the other colours in the original white light are absorbed. Now this absorption will depend upon the thickness of honey through which the light has to pass. Take two bottles of honey of the same colour and place them side by side, and the effect on the retina will be a certain colour, then place them one in front of the other and a much darker colour will be obtained.

This is an important point to be remembered by those bottling honey for sale, on account of the prejudice of the public in favour of light honey; honey bottled in tall, thin bottles will sell more readily than in short, fat bottles. The beekeeper selling honey has to remember the public prejudice, but at the same time he should point out the excellent food value of the darker honey owing to the presence of protein, phosphorus and iron, which are valuable body-building substances. He should also stress the value of honey as a carbohydrate food producing energy and vitality, and the ease with which it is assimiliated by the body compared with that of cane sugar.

NOTES ON FIRST REPORTED CASE OF LAMZIEKTE (PARABOTULINUS) IN CATTLE IN WESTERN AUSTRALIA.

(A. F. FLOOD, M.R.C.V.S., Dip. Agric.)

It may be of interest to readers to know that the first case of Lamziekte in Cattle in this State was diagnosed by the Veterinary Branch during February 1924, nearly six years ago. In response to an urgent letter and telegram from an Agricultural Society in the Eastern wheat belt reporting heavy losses in the district in 1923 and 1924 an investigation was made by the Veterinary Branch and the cause of the mortality was found to be due to Stiff Sickness, *i.e.*, Lamziekte. Owners were advised to burn all carcases of cattle and rabbits, etc., and to supply sterilised bonemeal to their cattle, especially to milking cows and heifers, either as a lick or mixed with the feed.

Since 1924 the disease has been reported from various centres, especially in the wheat belt and it is still responsible for considerable losses of stock. It is necessary at this time of the year to issue a warning to all stock-owners that carcases of rabbits, sheep or cattle left lying in paddocks are very dangerous to healthy stock, more especially during the Summer months. They should be burnt and ashes buried.

Cattle and sheep should be supplied with minerals deficient in pastures in the form of a lick. If licks are not available stock will not thrive, and may even die in a few days if infected by chewing infected bones in the paddocks.

THE UNSOUND ECONOMICS OF THE F.A.Q. STANDARD FOR SELLING AUSTRALIAN WHEAT.*

GEO. L. SUTTON,
Director of Agriculture.

In presenting this paper it is intended to establish—

(1) That the use of the F.A.Q. Standard is based upon misconceptions;

(2) That its use involves immense enonomic loss;

(3) That with its continuance the economic loss is likely to increase, and consequently

(4) That an improvement in the Standard by which our main crop is sold is desirable and possible.

Commercial standards, for the purpose of trading in Australian wheat, were unnecessary in the early days of our agricultural history, when the market was a restricted and localised one. Under such circumstances wheat could be, and was, sold by sample, i.e., its quality could be judged by a fair sample shown to, and examined by, the buyer at the time of purchase. Immediately, however, the personal contact between buyer and seller was broken or became impossible—as in the case of wheat sold for overseas—then commercial trading standards became necessary in order to smooth out the difficulties incident to trading when long distances separated the seller and the buyer. Such standards are obviously essential in order that buyers who cannot inspect the wheat offered for sale may have indicated to them the **quality** of the wheat they may expect to receive after purchase in a **reliable, understandable and definite manner, and at the time the offer is made.** Here it may be stated the present Standard does not comply with these requirements.

Because of the necessity for the adoption of trade standards, which arose consequent upon the evolution of our wheat industry with its expanding production, trading by sample gave place to trading under the F.A.Q. Standard.

The F.A.Q. Standard, by which wheat is at present bought and sold throughout Australia, is so-called because the letters "F.A.Q." are the initial letters of the three words in the term "Fair Average Quality," and by custom have become recognised as the commercial abbreviation for that term, and also because, as far as is practically possible, it represents the **fair average quality of the crop of the particular season for which it is fixed.**

It is not known when the system of selling according to the F.A.Q. Standard was first introduced, but probably it originated in South Australia shortly after wheat was first exported overseas.

Although there is an independent standard for each wheat exporting State, the procedure adopted in fixing the F.A.Q. Standard is practically the same throughout the Commonwealth. As the standard fixed relates to

* Paper read before the W.A. Branch of the Economic Society of Australia and New Zealand, on 31st October, 1929.

the crop of a particular season only, it is necessarily fixed annually. Fixing this standard has been regarded, therefore, as one of the high rites of the commercial wheat world, by which the wheels of commerce are oiled, and the purchase and sale of wheat facilitated throughout, and beyond, Australia.

In Western Australia the fixing of the standards is undertaken jointly by the Perth and Fremantle Chambers of Commerce, who bear the whole of the expense in connection therewith, including the collecting of representative samples of wheat from wheat-growing districts. The actual proceedings take place in alternate years at the headquarters of each Chamber. Last season the standard was fixed in Perth; this season it will be fixed in Fremantle. The President of the Chamber, at the headquarters of which the proceedings are carried out is, for the time being, in charge of the function, and is assisted by leading wheat traders of the State, who comprise the grain committees of both Chambers.

As befitting such an important commercial proceeding, the work is carried out with scrupulous accuracy and attention to detail. Every possible precaution is taken to see that the weighings and calculations are absolutely correct and the mixing thoroughly done. The Chambers of Commerce are justly proud of the equitable methods by which the F.A.Q. Standard has been fixed each year. No effort is spared to make it a fair and just representation of the grain harvested and available for sale. The personal service, voluntarily rendered by members of the Chambers when fixing the standard, is worthy of great commendation. It is often laborious, and would surprise those who are not familiar with what is done. As the result of eighteen years' intimate association with the actual work of fixing the F.A.Q. Standard in Western Australia, it is unreservedly stated it is impossible to conceive of more careful methods being devised for its determination.

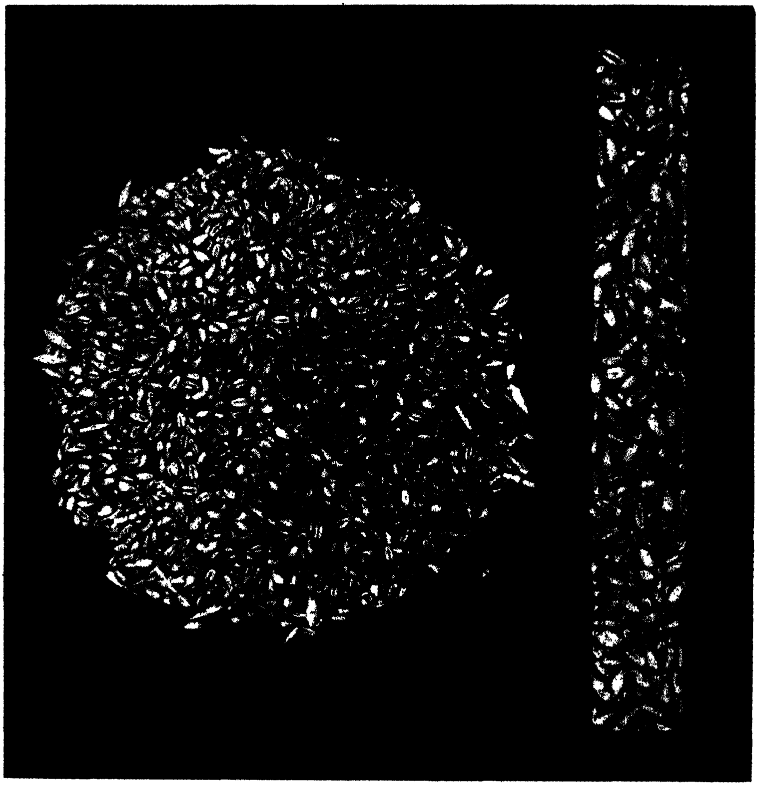
When the decision regarding the standard is made a declaration, as hereunder, is signed by the members and officials present. The declaration for last season read:—

> "We, the undersigned, present at the Chamber of Commerce, Perth, on Thursday, February 7th, 1929, at the fixing of the weight of the standard bushel of f.a.q. Western Australian wheat for season 1928-29, hereby certifiy that it was fairly taken, and the weight fixed, namely 62½ lbs. per Imperial bushel, in our opinion, is the proper weight for the season 1928-29."

It is pertinent at this stage to state that this Declaration does **NOT** comply with the requirements of a modern trading standard previously stated, viz., That it shall indicate the **quality** of the product in a **reliable, understandable and definite manner at the time the offer is made.**

It is signficant that the only detail in the Declaration, or definition, of the F.A.Q. Standard concerning its quality is that relating to its bushel weight. Because of the emphasis placed upon bushel weight in the official declaration, and the particular care taken to determine that of the current season's crop, not only in Western Australia, but in each of the exporting States, it is obvious that the declaration of the bushel weight is considered a reasonable and sufficient method of indicating to prospective buyers the information desired by them regarding the quality of the wheat available for sale, and also that it should play a very important if not vital part, in the settlement of disputes as to quality.

So much importance is attached to the bushel weight of the F.A.Q. Standard as to infer that it is the only information necessary to indicate its quality in a definite and understandable manner. This inference is based upon a misconception. It is fundamentally wrong, and may be entirely misleading, as may be seen from the following details relating to the two samples of wheat illustrated herewith: one of these illustrations represents the F.A.Q. Standard for 1928-29 and weighs 62½ lbs. per bushel, the other is a sample weighing 61½ lbs. per bushel, and, according to the inference to be drawn from the declaration of the F.A.Q. Standard, is the inferior sample. This,



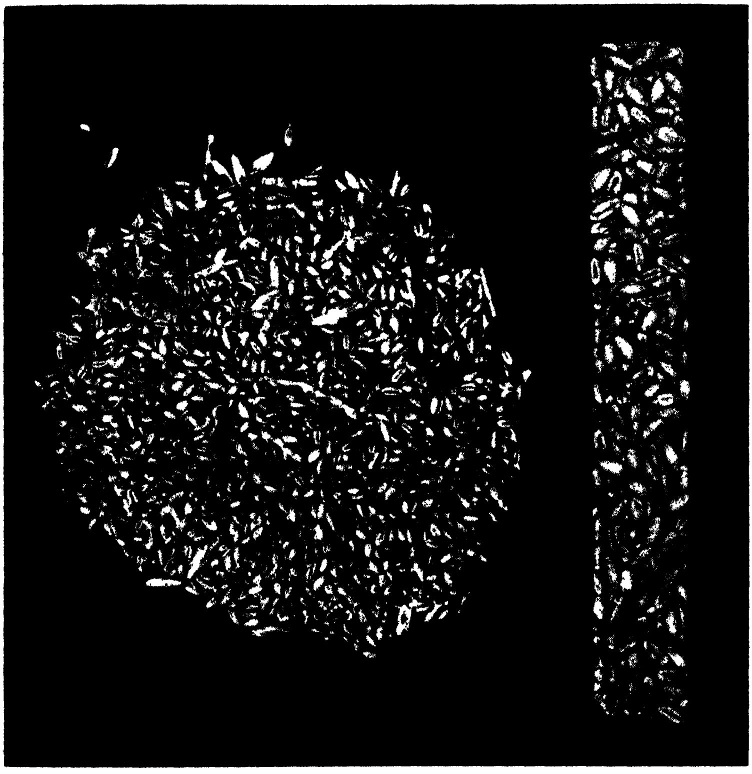
F.A.Q. Standard wheat. Bushel weight 62½ lbs.

Millable grain 97%.

however, is not so, for the millable grain is identical with that contained in the F.A.Q. sample; the quality and bushel weight of the "dressed" or millable grain is exactly the same, and there is nearly 1 per cent. (.8%) more of it. The difference in the bushel weight of the F.A.Q. sample and the other is due entirely to the difference in the character of the unmillable material which they respectively contain. The bushel weight to be of real value, therefore, for indicating the quality of a particular parcel of grain should refer to the

"dressed" grain only. There could be no clearer proof than this that the natural bushel weight of a sample of wheat cannot be accepted in all cases as a reliable index of its milling quality.

Additional evidence on this point is furnished by the fact that, despite the meticulous care taken to ascertain and declare the bushel weight, it is considered of such minor importance by the arbitrators dealing with disputed claims that it is entirely ignored by them. The percentage of millable grain, its character and condition as indicated by its colour, brightness and



Commercial wheat. Bushel weight 61½ lbs. Millalbe grain 97·8%

The quality of millable grain is the same as that in F.A.Q. The bushel weight is lower than that of the F.A.Q. Standard because of the difference in character of the unmillable material.

soundness, are considered of greater importance than the bushel weight, though no reference is made to these characters in the official declaration. This view is confirmed by the following extract from the letter of a prominent London wheat firm to their Australian representative, as under—

* * * * * This is practically the only wheat which this year has been persistently penalised in arbitration, and there has been a considerable outcry amongst

shippers, as they consider that wheat weighing 65lbs., as the shipments do, cannot possibly be inferior to a standard which weighs only 63lbs. At the same time, the delivery samples undoubtedly have a grey appearance which is not the case with the standard, and whilst a little rubbing considerably improves the appearance of the delivery, we must confess quite impartially that in spite of this, deliveries are rather inferior to the standard.

In order to convey to the distant buyer definite and reliable information regarding the quality of the grain being offered to him it is necessary that the declaration regarding the F.A.Q. Standard shall not only state the natural bushel weight of the cleaned grain, but that it shall also include **definite information regarding the amount and character of the millable grain it contains.**

Owing to the lack of this necessary information arbitrators in Great Britain are compelled to base their awards, not upon the careful determination of the bushel weight of the grain in dispute by means of a suitable mechanical appliance, but upon their skilled judgment, after examining and comparing (i.e. matching) a sample of the disputed grain with the actual sample representing the F.A.Q. Standard. Presumably the matching, as in the case of wool classing, is to determine by skilled and trained judgment, the relative percentages and characteristics of the millable grain in the two samples. If so, it has to be admitted that such a procedure is much sounder than reliance solely upon the natural bushel weight, but it is still unsatisfactory, as will always be any method which relies solely upon the judgment, however skilled and unbiassed, of any individual.

The importance which has been attached to the declaration of the bushel weight is probably based upon the generally recognised belief that the cleaner the grain (i.e. the smaller the percentage of impurities, and other material unsuitable for milling, mixed with it) the greater will be its bushel weight. Evidence that, under certain conditions, this belief is **to some extent** well founded is furnished by the fact that the bushel weight of the current season's F.A.Q. Standard is increased by 1 lb., when the unsuitable milling material (3 per cent.) is removed from it.

A second misconception is that the F.A.Q. does represent, as many people imagine, the **Fair Average Quality** of the **Whole** of the crop of the season for which it is fixed.

Theoretically the F.A.Q. Standard should be representative of the **Whole** of the State crop. The joint Chambers make a very earnest attempt to ensure that this is what the F.A.Q. Standard shall be. It is, however, practically impossible to achieve this. Despite the special efforts which are made the Standard arrived at cannot be representative of the whole of our crop, but will represent **only** the quality of the wheat exported **prior to the end of January.** It will not represent either the wheat stacked at, or being carried to, country sidings. Some of this is likely to have been harvested late in the season, and may be weathered, dull, or even bleached. Futher, it is inconceivable that any disinterested person associated with the actual fixing of the Standard would allow the inclusion of samples of badly bleached, sprouted, or badly smutted grain.

The very nature of the Standard requires that a large proportion of the season's crops shall have been harvested before the Standard can be fixed, and, in consequence, the determination of the Standard has to be delayed for at least two months after wheat deliveries have commenced. This delay is unavoidable whilst such a Standard is retained. This feature was most unfavourably commented upon by the President of the Liverpool Corn Trade Association in March, 1923, when addressing the Australian editors then touring Great Britain. He pointed out that one of the troubles of the trade in Liverpool (which, of course, applied to other parts of the United Kingdom) was the delay which occurred in connection with the forwarding of standards of the new Australian crop. He further stated that it was then March, and the standards had not been received, although the cargoes sold according to those standards had arrived. This unsatisfactory phase of the matter is well illustrated by the quantity of wheat exported prior to fixing the F.A.Q. Standard during the 1925-26 season, for which figures are available. In that year it could not be fixed, as is usual, until nearly the middle of February and at that date 4,827,597 bushels, or 41 per cent. of the total quantity exported to the end of July, had been shipped, and by the time the sample was received in Great Britain this had increased to 63 per cent.

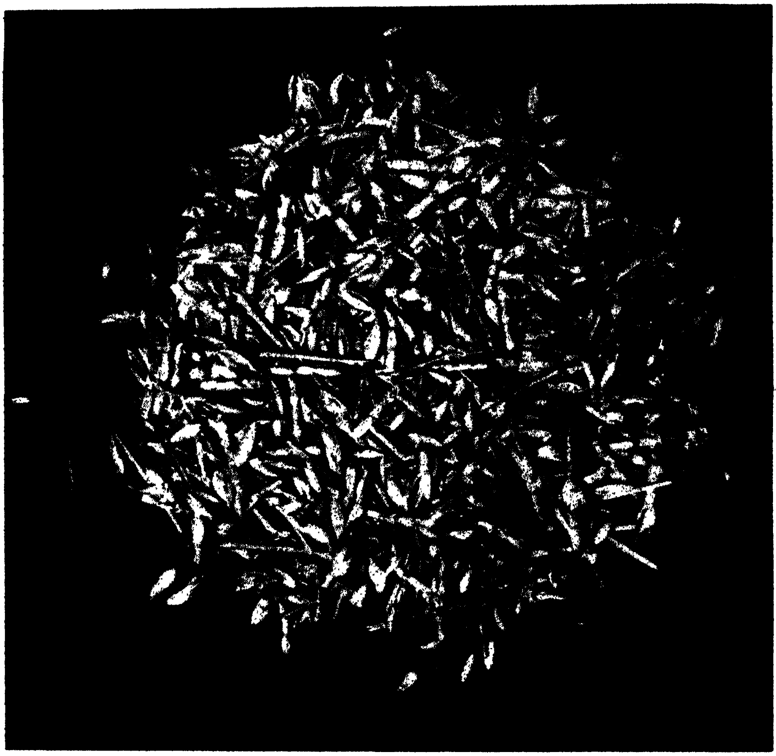
The F.A.Q. Standard, therefore, fails to comply with another requirement of a modern trading standard in that it is impossible to indicate, **at the time the offer is made,** the quality of the grain being offered to the overseas buyer. Overseas buyers are undoubtedly seriously inconvenienced by this drawback, which is unavoidably associated with an F.A.Q. Standard. The inevitable delay is a very probable source of friction between buyer and seller. It is reasonable to assume that this inconvenience is reflected in the price paid by the shippers of our grain, and that, in consequence, the grower does not receive its full value, or the higher price which could be paid if the risks now inseparable from trading under the present F.A.Q. Standard, and due to the inability to fix it at the beginning of the harvest season, were decreased as they can be.

Australia is in effect still trading in wheat by sample instead of, as is generally believed, by "standard," and the real position is that, prior to the receipt in Great Britain of the F.A.Q. Standard sample, buyers are to some extent "buying a pig in a poke," and trading in our wheat is only possible because past experience has taught them, within limits, what to expect. There is, however, a certain amount of uncertainty about the quality, for which a suitable margin must be provided.

As is quite in accordance with our tradition of British justice, buyers have the right to arbitrate in cases where they have a doubt as to whether the quality of the grain they are receiving is equal to that of the Standard. Arising out of this quite proper provision for the settlement of disputes, the purchaser of shipments bought prior to the arrival of the F.A.Q. in Great Britain invariably gives notice of his intention to arbitrate. In order to safeguard the buyer for the inconvenience and risk of having to purchase wheat during the greater part of the season according to a yet unknown standard the right to arbitrate has had to be extended to an unusual extent, and, in consequence, the claims for arbitration can remain in abeyance until

21 days later than the receipt of the F.A.Q. Standard sample. It can thus happen that final payment regarding the sale of a wheat cargo may remain in abeyance for three or more months after the sale has been made. Such a condition cannot be regarded as satisfactory, and it would be difficult to find any other commodity of importance subject to such trading conditions.

It is opportune now to draw attention to the economic unsoundness of this method of trading, and to call attention to the losses which occur



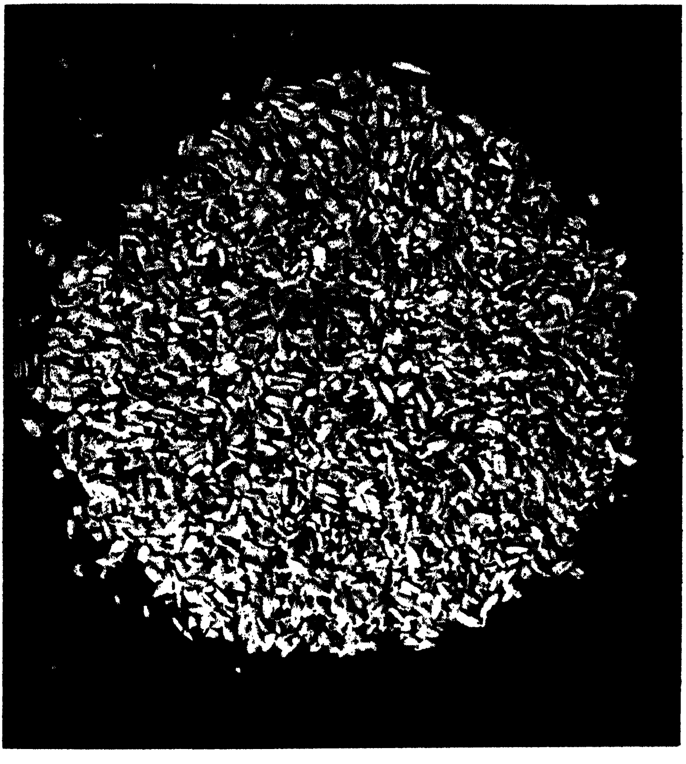
Unmillable material—foreign matter, chaff and back bone—found in the F.A.Q. and amounting to 0·6%. In a 50,000,000 bushel harvest this amounts to 8,035 tons.

Why pay freight and other charges on what is useless to the miller?

as the result of our adherence to it. If, as is contended, the fixing of the F.A.Q. Standard is based upon a misconception, then the first loss is incurred in the work involved in connection with its determination; the expense and trouble are, therefore, wasted. The amount involved is a few

hundred pounds, and as it is almost infinitesimal compared with the tens of thousands sterling lost in other ways associated with trading according to the F.A.Q. Standard, it may be ignored.

Some margin for contingencies in trading with wheat is recognised as necessary, but the uncertainty associated with the quality of the wheat, pending the fixing of the F.A.Q. Standard, and the probability, almost a certainty, of an allowance being granted against the shipper as the result of an arbitration—particularly if the price of wheat falls after the sale—



Fine unmillable screenings forming 2·4% of F.A.Q. wheat or amounting to 32,142 tons in a 50,000,000 bushel harvest.

Is it sound economics to pay freight and other charges on this and other unmillable material? It can be used to excellent advantage on the farm for stock feeding.

presupposes a special margin to provide for it. Assuming this special margin to be 1 per cent., though to one outside the trading circle it appears easily possible for the magin to be twice this, the loss to Western Australian farmers on a 30,000,000 crop would be £75,000, and to Australian farmers on 132,000,000 bushels—£330,000.

A further and extremely serious instance of the unsound economics of the F.A.Q. Standard is the lack of encouragement to farmers to utilise to the best advantage the engineering skill used in the construction of Australian harvesting machinery. Because of the excellence of this machinery it is believed, after allowing for difficulties inseparable from field work, that the grain can be so "dressed" or cleaned that no more than 1 per cent. of screenings or other unmillable material need be left in it. The F.A.Q. Standard allows for at least three times this amount, and, in consequence, many farmers now cover up or remove the tailing screens from their harvesters, whilst the more scrupulous ones allow them to become choked, thus deliberately lowering the commercial value of our main agricultural product by including a much larger percentage of unmillable material—foreign matter and screenings—than is necessary. This involves great economic waste. How great is this waste which permits unnecessary non-millable material in the standard will be seen from the following figures, which show the tonnage involved in handling different percentages of the estimated quantity of wheat sent to the Western Australian mills, and sea-board in 1927-28. A conservative estimate of the harvest handled that year would be 30,000,000 bushels, or 803,030 tons—

1 per cent. of this would mean	8,030 tons
2 per cent. of this would mean	16,060 „
3 per cent. of this would mean	24,090 „

or taking the 5.5 per cent. of unmillable material found in the F.A.Q. Standard for that season—1927-28—it would amount to 44,165 tons, or nearly nine full steamer cargoes of 5,000 tons each.

As already pointed out it is considered practical and quite reasonable to exclude all the unmillable material in excess of 1 per cent. from our commercial wheat. An estimate of the loss incurred in handling this unnecessary amount—4.5 per cent. in 1927-28, say, 27,000,000 bushels is as follows—

Export—say, 27,000,000 bushels, 4.5 per cent of which—1,215,000 bushels = 32,545 tons.

	£	s.	d.
Sacks—405,000 at 10s. per dozen	16,875	0	0
Cartage, say, 32,545 tons at 5s. per ton	8,136	5	0
Railway freight, say, 32,545 tons at 12s. per ton ..	19,527	0	0
Sea Carriage, say, 32,545 tons at 40s. per ton ..	65,090	0	0
	£109,628	5	0

That that is the case is indicated by the fact that the bulk of the wheat inspected for certificated cargoes and parcels during the early part of the current season and up to the middle of December, 1929, contains less than 2 per cent. of unmillable material and in consequence has the high bushel weights of 65 and 65½ lbs. It has been suggested that the improvement in quality is due to the salutary influence of the Wheat Bags Branding Act now operating for the first time; if so it shows the need for a little pressure or stimulus in order to ensure that our wheat growers shall use their excellent harvesting machinery to the best advantage.

In addition to this there is unnecessary expense or loss connected with the wheat used for local consumption in 1927-28 estimated to be 4.5 per cent. on 3,000,000 bushels—135,000 bushels—3,616 tons—

Home Consumption—	£	s.	d.
Sacks—45,000 at 10s. per dozen	1,875	0	0
Cartage, say, 3,616 tons at 5s. per ton	903	15	0
Railway Freight, say, 3,616 tons at 6s. per ton ..	1,084	16	0
	£3,863	11	0

	£	s.	d.
Export	109,628	5	0
Home Consumption	3,863	11	0
	£113,491	16	0

Though the percentage of unmillable material—5.5 per cent. on which the calculations have been based is the quantity actually contained in last season's F.A.Q. Standard it is admitted to be abnormally high, for the average for a number of years is about 3 per cent. In consequence it is fair to assess the normal loss in this connection on a 30,000,000 bushel harvest at about £50,000.

In 1917 Messrs. Scott and Winslow, of the Chemists' Branch, Victorian Department of Agriculture, made some investigations regarding the percentage of unmillable material found in Australian commercial wheat, and this was estimated by them to be 4.35 per cent. Using this figure it may be assumed that the unnecessary millable material amounts to 3.35 per cent. and the loss involved in connection with a Commonwealth crop of 74,000,000 bushels for export and 58,000,000 bushels used locally is as follows—

Export—	£	s.	d.
Sacks—826,333 at 10s. per dozen	34,430	0	0
Cartage, say, 66,400 tons at 5s. per ton	16,600	0	0
Railway Freight, say, 66,400 tons at 12s. per ton ..	39,840	0	0
Sea Carriage, say, 66,400 tons at 40s. per ton ..	132,800	0	0
	£223,670	0	0

Local Consumption—	£	s.	d.
Sacks, 647,666 at 10s. per dozen	26,986	0	0
Cartage, say, 52,045 tons at 5s. per ton	13,011	0	0
Railway freight, say, 52,045 tons at 6s. per ton ..	15,613	0	0
	£55,610	0	0

	£	s.	d.
Export	223,670	0	0
Home Consumption	55,610	0	0
	£279,280	0	0

This amount is stupendous and even supposing the amount of unavoidable unmillable material is reduced to 2 per cent. it approaches the startling figure of £170,000. It is too great to be passed over lightly in times like these, especially when to it must be added other incidental charges connected with the handling of this unnecessary material amongst our wheat, e.g. agents' fees, labour charges for stacking and the face value of the unmillable material for which the buyer may or may not pay, but which would undoubtedly have a value, and its best value, on the farm for stock feed. The economic loss is so great, and because most if not all of it is unavoidable, would seem to demand an immediate change in our Standard. This is especially so when the continuance of the present Standard has a tendency to increase the loss.

Apart from the fact that it does not and cannot be made to represent the F.A.Q. of the whole of the harvest the principal defects of the present Standard are—

(1) It cannot be fixed early enough for the requirements of the trade;

(2) Disputes as to quality are now dependent upon the personal judgment or opinion of a skilled individual, and

(3) It does not encourage the improvement that is possible and practicable in the "get-up" of our wheat crop.

The first defect, viz., the late determination of the Standard can be remedied by the adoption of a **permanent standard** which will operate from year to year.

Dissatisfaction will always exist whilst disputes as to quality rest solely upon the personal opinion of any individual, however skilled and experienced he may be. This is especially the case when the seller has no definite information, as at present, regarding the basis on which the arbitrator forms his opinion. Though it is admitted that, as the result of many years of experience, some men become remarkably skilful in assessing the relative values of two parcels of wheat, yet such a method is no longer in accordance with the progress which has been made in connection with our knowledge of wheat and its value for milling. During comparatively recent years a great deal of investigational work has been carried on in connection with the milling properties of wheat, and information is now available so as to provide a "technique" whereby the samples of the parcels in dispute can be dissected into their component parts, and their milling value, i.e., their commercial worth evaluated, in many cases on a much sounder basis, and to the disputants on a more satisfactory one, than an expression of opinion as the result of "matching." The dissatisfaction which now exists can be minimised by the elaboration of the Standard so as to include in the declaration now made, definite and reliable details regarding the amount and character of the millable grain in it as well as giving the bushel weight of the cleaned grain. With the inclusion in the declaration of such definite information it will be possible to remove much, if not all, of the dissatisfaction, which has always existed, and will continue to exist whilst a decision rests upon person judgment, however skilled and unbiassed it may be. With an extended declaration as indicated it will be possible to assist the skilled

judgment by simple and accurate tests, in much the same manner as the bushel weight of a small sample of wheat is determined, not by empirical means, but a specially devised instrument called a chrondometer.

The third defect associated with the F.A.Q. Standard can be remedied, and advantage taken of the excellence of our harvesting machinery, with a consequent improvement in the "get-up," which can be ensured to a greater extent than at present by providing that the Standard shall specify a smaller quantity of unmillable material than is found at present in the average of the F.A.Q. Standards, or it may be ensured completely by providing that the Standard shall refer to the millable grain only, as is the case with the Canadian standards. The latter plan will ensure, as any sound method should, "payment for quality," and is in line with the method of trading in cream and wool. In the case of cream, its value is based upon the amount of butter fat it contains; in the case of wool, upon the yield of clean scoured wool which can be obtained from the greasy product.

It will thus be seen that some of the defects associated with the present F.A.Q. Standard can be remedied by an elaboration of the declaration relating to the F.A.Q. and all of them by the adoption of a **permanent standard** which defines in an understandable manner the **amount** and **character** of the **grain** and **which limits the percentage of unmillable material.**

It is obvious that a change as suggested cannot be made without objections being raised to it. What are they? In the first place there is the unconscious objection to any proposal to disturb the existing order of things. This is founded mainly on the fear of the unknown which most of us possess and a preference "to trust the Devil we know rather than the Devil we don't know."

It has been said that trading according to a permanent Standard means trading according to a definition or formula and that this is impracticable. But is it? A definition or formula of the Standard agreed upon is neither more nor less than a description of the physical characteristics to which such a Standard shall conform. It is such a description or definition as might reasonably be expected, even under the present method, from a merchant seller by a prospective overseas buyer not familiar with the characteristics of the F.A.Q. Standard.

As showing that it is quite practicable to trade according to a definition or formula it may be stated that for several years the Chamber of Commerce were unable to give an F.A.Q. Standard for export oats, during which time there were several disputes and considerable trouble incidentally illustrating the need for commercial trading standards. Eventually, under the auspices of the Chambers of Commerce, the merchants met, and after consultation with the officers of the Wheat Branch of the Department of Agriculture, the following export **Standard for Western Australian Feed Oats** was decided upon. Its description is—

> "W.A. Standard Feed Oats shall be bright, sound and free from musty, smutty and other objectionable smell. It shall contain by weight not less than 96 per cent. of oats; not less than 14 per cent. of prime oats, and not more than 6 per cent. of screenings oats; nor shall there be more than 1-20th per cent. by weight of the seeds of "Speargrass." The bushel weight shall not be less than 37 lbs."

Surely it cannot be said that any person familiar with the oat trade could not understand very definitely from such a formula what he was either buying or selling, or that, in addition, an examination of a physical Standard would be necessary in this connection or to settle disputes.

If further evidence be needed in this connection the experience of our officers of the Wheat Inspection Branch will provide this. Each year the cargoes conforming to the permanent "W.A. Standard White" are necessarily dealt with according to a definition or formula. Further, immediately the F.A.Q. Standard is fixed by the joint Chambers of Commerce it is now the practice of the Wheat Inspection Branch to set out its characteristics in a definition or formula, so that those responsible for the inspection may work according to it, rather than rely upon the actual comparisons which can be made with the physical Standard supplied by the joint Chambers of Commerce. Thus the whole of the wheat shipped under Government Certificate during the season just ended was dealt with according to a definition or formula. This fact represented by 14,200,000 bushels admits of no argument. Those of our inspection staff who have had experience of the wheat inspection work under both systems, that is—

(a) by comparison with a physical Standard, and
(b) by examination according to the definition,

are emphatically in favour of the latter and present method.

Further, it is pointed out that when the wheat submitted for certificate was dealt with under the old method of actual comparison with a physical Standard, and prior to the introduction of the present method of critically examining the grain to ascertain if its characteristics are as defined, there was infinitely greater dissatisfaction than at present.

The use of a definition does not, however, do away with the necessity for trained experience, such experience is still necessary to interpret properly the terms of the formula as understood by the trade.

It must be realised that the Standard is not so much one to which cargoes must conform in their entirety, but rather a means by which they can be evaluated, just as the varying dimensions of timber can be ascertained by means of a foot-rule. It is believed a distinct advantage, consequent upon the general use of a definition, with or without the help of a physical Standard, would greatly facilitate the adjustment of those differences in value due to variations between the wheat purchased and the Standard by which it was bought.

There is nothing unusual in having a fixed Standard. The great exporting countries of Canada and the United States of Amercia have them, and it is recognised to their advantage. Geographically Canada and the United States of America are more conveniently situated to the great wheat consuming centres than Australia, and yet both found it imperative and advantageous to adopt and market their wheat according to a system of permanent standards ("Grades"). Further, because of the greater diversity of types and varieties, these countries had far more initial difficulties to overcome in deciding what these permanent standards ("grades") should be, than Australia will have. The difficulties which both these countries had in deciding what permanent standards to adopt, and the number they are compelled to have, may possibly have caused some people to hesitate to advocate the adoption of permanent standards in Australia. There is, however, no real ground for hesitation.

The very fact, however, that the Canadian plan is to sell according to permanent standards is probably the main cause of the British objection to the change proposed. Associated with the Canadian Permanent Standard is the system of official certification as to weight and quality, and which is final at the loading port, and, in consequence of which, British buyers have no right of arbitration in connection with the purchase of certain grades of Canadian wheat, as they have with all Australian wheat. This phase is brought out by the Press report of an interview which the Hon. W. F. Dunn, Minister for Agriculture, New South Wales, when in England in 1925, had with the millers, and shows that they fear that if permanent standards were adopted in Australia they would lose the right which they possess under the present standards to submit claims to arbitration. That, however, would not be the case, and the adoption of a more definite standard would lessen the need for arbitration.

There is no wheat exporting country in the world which lends itself to the adoption of permanent standards under easier or more economic conditions than Australia. All the wheat States grow the same class of wheat under practically the same conditions, and the exportable surplus of each State is usually sold under the definition F.A.Q. This varies only sightly from year to year, and mainly in regard to the percentage of impurities it contains, which, in turn, influences the natural bushel weight. Thus a standardisation system suitable for one State would be suitable for all States.

Another objection not stated is undoubtedly that the adoption of a Permanent Standard involves a change in the mental attitude of those dealing with our wheat in the past. A Permanent Standard implies and requires a definition of its characteristics. Those in the wheat trade have been evaluating our wheat by the appearance of a physical standard, and any division into its component parts has been done sub-consciously. Some judges of commercial wheat become extremely expert in this direction; on examination of two samples they are able to say definitely whether one is better or equal to the other, but just why, they possibly are unable to say. It is true the new method at first would involve an entirely new outlook, similar to that required of a man who had previously dealt only in sovereigns or other metallic currency, who was suddenly asked to accept payment in notes, or by a perfectly sound cheque. This, however, need not be an insuperable objection, for if a sample of the Permanent Standard is considered essential, then it can be supplied. Herewith is an illustration of one of the Permanent Standards already existing in Western Australia. It is known as "**W.A. Standard White.**" It has been prepared from the season's wheat in accordance with the definition of same which is practically identical with the average F.A.Q. Standard for a number of years, and is as follows:—

W.A. Standard White Wheat.

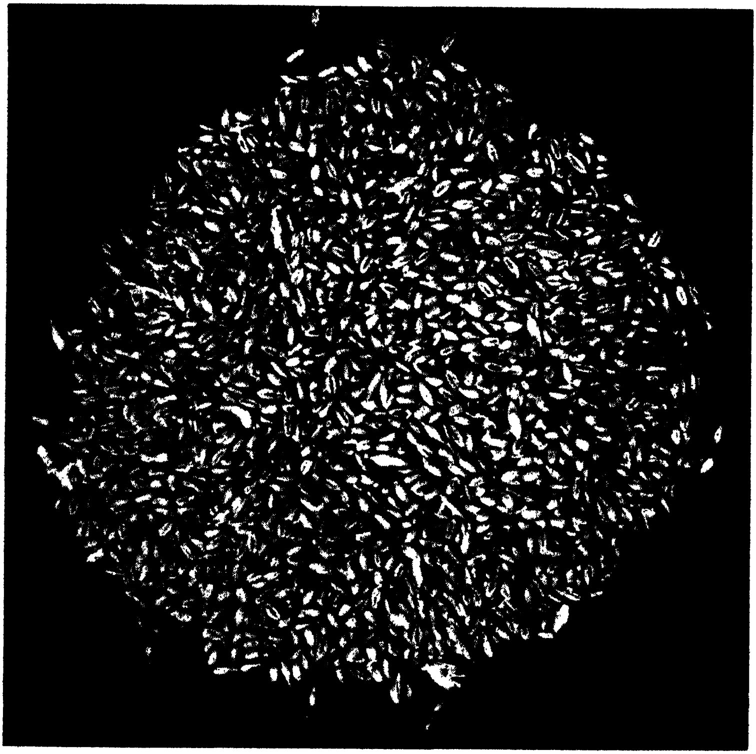
The grain to be Sound and fit for Shipping.

Quantities—

Bright and Sound Grain	95.5 per cent.
Total Millable Grain	97.0 „ „
Total Foreign Matter	3.0 „ „

Bushel weight of cleaned grain—62 lbs.

Another objection brought forward is that because our wheat is in bags, it is impossible to deal with it according to fixed standards. This is not so. This idea has probably arisen because of a very general belief, in which the writer shared, that bulk grain is always cleaned from screenings and foreign matter on being received from the farmer or before de-



"W.A. Standard White,"
a sample made up in accordance with the definition, viz.:—

Bright sound grain	95·5%
Total millable grain	97·0%
Total unmillable material	3·0%
Bushel weight 62 lbs.	

spatch overseas. Bulk wheat, and the facilities at elevators enable this to be done, but the practice is anything but general. Except that bulk wheat can be sampled rather more readily than bagged wheat the procedure under a system of permanent standards would be the same with bagged as with bulk wheat, and would present no greater difficulty. This has been proved by the fact that this season over 14¼ million bushels, or over 58 per cent. of the total wheat exported, have been sampled at Fremantle as for a Permanent Standard.

It is also stated that the change would mean a drastic alteration of our present methods. This, however, is not so, the making of the change suggested would in no way interfere with or disorganise existing methods of dealing with the grain crop. The present method of buying from farmers by sample, and according to the judgment of the agent could continue, but, because of an accurate definition of what the standard consists, the adjustment of differences in case of disputes, either overseas or in the State, could be settled by skilled judgment assisted by simple and accurate tests, instead of, as at present, by personal though skilled judgment only.

Already there are two fixed standards for wheat in use in this State. One of these is known as the "W.A. Standard White." It was forced into existence by the requirements of certain sections of the export trade. This has been used for Government certificated cargoes each year for the past five years from the opening of the season until the fixing of the F.A.Q. Standard by the joint Chambers. Last season 7,546,116 bushels (202,128 tons) or 28 per cent. of the export wheat, was shipped according to this fixed standard, and in 1924 the proportion of the crop shipped under Government certification prior to the fixing of the F.A.Q. Standard was 61.3 per cent.

The other is the Standard by which the specially strong wheat of the "Comeback" type is sold. This Standard is not fixed each year as is the F.A.Q. Standard, nor has it ever been officially fixed. It has become recognised by custom, and except that the bulk of the grain is "horny or steely" instead of opaque or starchy it is similar to that of the "W.A. Standard White." Because of its superior milling quality, and because it commands a higher price, it has been called the "W.A. Premier Standard White."

There is nothing revolutionary in making a change in our wheat trading Standards; the change suggested is simply an ordinary evolutionary phase of our development.

Just as the F.A.Q. system supplanted a less suitable one, so it is believed that, because of our greater expansion, it is now desirable that our present F.A.Q. Standard, which has served its turn, should give place to a more modern one of trading according to permanent standards, a system which is more in keeping with the march of standardisation, and in line with the practice in other branches of commerce. It is believed that the first step in the evolutionary process is to elaborate the declaration issued in connection with the F.A.Q. Standard so as to include the percentage of millable material in it, together with definite information regarding its character.

THE VALUE OF THE POTATO SEED PLOT.

W. E. COLLINS,

Potato Inspector.

The use of seed plot combined with tuber selection is the most practical and effective measure for the production of disease free stocks known.

Degenerate diseases can be controlled, Fusarium Wilt may be held in check and the malformed plants and defective tubers caused by Rhizoctonia may be got rid of by the "seed plot" method of selection.

What is required, is that each grower should select when digging, the progeny from healthy, high yielding plants and reserve these for a special seed plot in the following season. The plot should be isolated, and planted quite separately from the commercial crop. The greater the isolation, the more certain will be the results.

During the period of growth, the plot must be given the utmost attention in the matter of eradicating all weakly and abnormal plants. By adopting this method each season, a system of continual selection would be carried out, and the progeny from undesirable and diseased tubers would be eliminated—so bringing the seed to a very high standard.

It has been clearly established that virus diseases, such as Mosaic and Leaf Roll, are carried from season to season in the seed tubers, and that infected plants do not recover, but their progeny reproduce the disease each successive year. It is also known that virus diseases are transmissible, and healthy plants, if surrounded by, or grown in close proximity to diseased ones, are liable to contract the disease by reason of aphis and other leaf-sucking insect attacks and show it the following season in reduced yields

If "rogueing" is carried out with extreme care and thoroughness and if insect attacks be prevented by spraying or dusting with a good insecticide, complete success should be possible.

Those growers in the Great Southern districts who grow for certified seed purposes, should remember that, though virus troubles may be comparatively slight there, large areas in the South-West require an annual supply of southern grown potatoes for seed, because of the rapid degenerate diseases engendered under the conditions existing, and the demand for seeding relatively free from Mosaic and kindred troubles will increase. Disease free stocks, therefore, should be retained and worked up for seed purposes.

The importance of preserving the foliage as nearly intact as possible must appeal to all intelligent growers. The leaves of the potato plant must be kept in a thrifty condition if a clean maximum crop is to be obtained. Both insects and fungus diseases should, and can be fought and conquered if the well known and thoroughly tested preventives are used. Remedies should not be delayed until the tops are badly injured. It is well known that the loss in a crop where the tops have been allowed to be devoured by insects, or fungal troubles to take hold, is heavy, the crop sometimes being scarcely worth the digging.

Unfortunately, with perhaps the majority of growers, nothing is done to destroy pests until the foliage is partly eaten, or the leaves become

covered with the spores of early blight. This is too late. By the time the remedies take effect, the tops are badly injured and the future crop much lessened.

Growers should not wait until this happens, but should be continually on the lookout for pests, and as soon as they appear an application of some remedy should be made.

It should be rememberd that spraying or dusting for controlling fungal diseases is a prevention, and not a cure. If the disease makes its appearance in the crop, before spraying is done, in most cases efforts after that will be next to useless.

Spraying or dusting for controlling insects, especially the Rutherglen Bug, should also be regarded as a preventive. Up to the present, home-made Bordeaux mixture or the commercial Bordeaux powder has been found to be the best for potatoes. With the addition of Arsenate of Lead (paste form), for the wet mixture and Arsenate of Lead (powder form), for the dusting—either makes an almost perfect control if the plants are thoroughly done. There are strong advocates for both the wet and dry mixtures. The dry powder applied with a dust gun, is certainly less laborious and quicker. It is claimed that seven acres of potatoes per day may be treated by this method, and it is gaining in favour with the large scale tomato growers of Geraldton and the market gardeners in and around the metropolitan areas.

If the best results are to be obtained, apply the powder on a calm morning, when the leaves are wet with dew or late on a still evening. It adheres better than the spray and will also be more evenly distributed.

Spraying may be done at any time when the weather is fine, and should be made every ten days or two weeks throughout the season in order to keep the new growth covered. The cost of spraying or dusting is not large compared with its many advantages. The crop will be increased, by increasing the effective area of the green leaves which manufacture the substances stored as potatoes. The rotting of tubers, both in the soil and in the storage, will, to a very great extent, be prevented. Therefore, proper spraying or dusting pays.

Early digging of the seed crop is another point for consideration, and one which is likely to contribute to success in obtaining and keeping seed free from Mosaic and kindred maladies. A certain period of time—it may be a short one—must elapse subsequent to inoculation with the virus, before the latter reaches every part of the plant. By early digging, therefore, it may be possible to secure healthy tubers from recently infected plants. A crop dug in an immature stage, is not exposed so long to disease infections as is one allowed to ripen completely.

To give effect to all that is suggested in this article, one must resort to wider planting. The distance between the rows should be such as to allow the grower easy access through the plants during the whole period of growth. "Pride goeth before a fall" it is said, and very often that nice-looking, even, closely grown crop of potatoes is its undoing.

The average grower hates to tramp into such a crop, and it is only on noting black patches or discolourations appearing, that he ventures to investigate. What can he do then? The very density of the foliage prohibits anything being done. It becomes a harbourage to insect pests, or fungal diseases and must be left to take its chance until digging time, entailing reduced yields, and the possible carry-over of disease infected seed.

PASTURES.

IN AREAS OF MEDIUM RAINFALL.

G. K. BARON-HAY,
Assistant Superintendent of Dairying.

PASTURE EXPERIMENTS AT BODDINGTON.

Considerable difference of opinion exists as to the most economical methods of establishing pasture, particularly Subterranean clover, in districts with an annual rainfall of from 20-25 inches. These experiments were inaugurated at the request of the Boddington Progress Association to demonstrate methods suited to the district.

The plots included three types of soil:—

(a) Light sandy loam, with clay at considerable depth, carry Stink bush and scattered Red Gum (E. calophylla);

(b) Light loam, overlaying clay at 9 inches, carrying Red Gum;

(c) Loam, overlaying quartzose hardpan at 12 inch to 15 inch, being a typical Wandoo (E. redunca var. elata) flat.

These types were planted on 27th May by the following methods:—

(1) 2 lbs. Subterranean clover per acre, drilled in with 60 lbs. of Algerian oats.

(2) 2 lbs. Subterranean clover per acre *broadcast* after the oats had been drilled.

(3) 1 lb. Subterranean clover per acre *drilled with* 60 lbs. Algerian oats.

(4) 1 lb. Subterranean clover per acre broadcast after the oats had been drilled

1 cwt. of superphosphate was applied in all cases.

Results may be summarised as follows:—

(a) Wet Wandoo flats gave good growth, the growth being equally good when the Subterranean clover seed was broadcast or when drilled. These soils are unsuitable for crop growing.

(b) Very light sandy loam gave poor growth of both clover and oats.

(c) 1 lb. of seed gave quite a good stand, and where 2 lbs. per acre had been sown, and good growth followed, the clover had stifled the oat crop. This fact would have been accentuated had the normal quantity of rain fallen.

From observations, in this district and in others with similar conditions, the most economical method of establishing Subterranean clover is by sowing the seed with an oaten cover crop. For this purpose 1 lb. of good clean clover seed per acre is sufficient. Light sandy soils with no clay subsoil should not be treated.

The author has noticed that in light rainfall districts Subterranean clover often fails to bury the seeds, and there is a danger, if stocked the first season with sheep, that the seed "burrs" will all be eaten and a poor stand obtained the second year. On an average stand, the writer strongly recommends that the area be not stocked with sheep the first year.

Good results are not general in the lighter rainfall areas where the seed and superphosphate are applied to untreated land. Stirring the surface with a cultivator or sundercut is recommended before sowing.

WEST ARTHUR PASTURE COMPETITION.

There is no doubt that on the successful development of pastures in the districts surrounding Darkan rests the future prosperity of the land owners. The action of the West Arthur Agricultural Society in offering a prize for the best 10 acres of pasture is to be commended.

The useful rainfall up to the time of judging on October 25th was as follows, being particularly light in September and October, and 4 inches below the average for the season.

April	May	June	July	August	September	October
45	324	500	191	173	86	64

In spite of the dry spring, however, good stands of pasture were seen, long enough to be cut for meadow hay.

The following Table gives the results of the competition:—

— —	Yield.	Freedom from Weeds.	Useful Grasses.	Freedom from Disease.	Evenness of Growth.	Total points.
	45	15	15	15	10	100
E. L. Walker, Bokal ...	45	13	10	15	9	92
A. C. Cummings, Darkan ...	38	13	12	14	7	84
W. J. Wunnenberg, Darkan ...	32	11	11	14	8	76
E. J. Clugston, Bokal ...	34	10	8	14	5	71
H. Harrison, Bokal	22	10	8	14	9	63
H. C. Pobjoy, Duranillin ...	22	11	12	11	5	61
F. Wood & Son, Darkan ...	22	10	10	14	5	61
F. B. Horwood, Darkan ...	16	11	10	14	9	60

The winning crop owned by Mr. E. L. Walker, Bokal, demonstrated that, even in an unsatisfactory season, good Subterranean clover yields can be obtained on Wandoo flats. Under the old system of crop growing, these flats were looked upon as of little value but are now proving the best areas for the growth of Subterranean clover.

This area was established in 1925 by Mr. Walker, using 5 lbs. of clean seed per acre on ploughed ground, without a cover crop. The area was topdressed in April with 90 lbs. superphosphate, and again in early September. This latter dressing, however, had not yet been washed into the soil.

Mr. Walker favours a heavy dressing of seed, claiming that a heavy growth is obtained the first year. It is doubtful, however, whether the larger area sown with 1½ to 2 lbs. seed per acre is not more profitable. This latter is the system most practised, and two good stands of clover established by this method was exhibited by the second prize winner, Mr. A. C. Cummings, Darkan. This plot of 20 acres was established by using ¾ to 1 lb. clean seed, without a cover crop but on scarified soil three years previously.

Mr. Cummings now has 1,400 acres sown with Subterranean clover at the rate of 1 lb. of seed per acre applied with a drill, without ploughing, using an autumn and spring dressing of 90 lbs. superphosphate. The results are excellent, showing the suitability of this clover to the average lands in the district.

From the results of the competition, it may be inferred that:—

(1) Subterranean clover will thrive on the Wandoo flats hitherto not considered valuable.

(2) May be established by scarifying the ground, using 1½ to 2 lbs. clean seed with 1 cwt. superphosphate per acre.

(3 A second topdressing with superphosphate is warranted where meadow hay is to be cut.

Mr. E. L. Walker, Bokal—The winning crop of Subterranean Clover.

CHEAP PASTURE PRODUCTION—NORTH DRAKESBROOK.

A series of experiments were designed two years ago to demonstrate economical methods of establishing pasture on the wet sandy loams, overlying clay at varying depths (up to 2 feet), which soils are general in the country between North Dandalup to Wagerup.

These experiments which were conducted at North Drakesbrook, at the request of the North Drakesbrook Progress Association, have yielded some valuable information during the two years they have been in existence.

The experiments were designed to shed light on the following points, all of which are of interest to local farmers desiring to bring this type of country into production.

Ploughed versus Unploughed Land.

The land in question is too wet in the winter to grow a crop, and it was found that, although the growth of sown plants was good on all plots, growth was noticeably greater on the unploughed than on the ploughed land.

Where ploughed the land was rapidly water-logged, and it would have been quite impossible to graze stock on it during early spring. This could have been done on the unploughed areas at any time during the growing period.

From the results obtained, the cost of ploughing here is not warranted.

Fallowing did not give a better growth the first year than when sown on freshly ploughed land.

Ploughing to a depth of 2 inches only "puddled" the land as much as where it was more deeply ploughed, and did not have the desired effect of killing the scrub. It is preferable therefore, where ploughing is carried out to do the work thoroughly.

Plants to Sow.

The following mixture of plants was sown on May 19th, 1928, on cultivated ground, to demonstrate the plants most suited to this type of soil.

Subterranean clover	4 lbs.
Crimson clover	1 lb.
White Dutch clover	1 lb.
Paspalum dilatatum	5 lbs.
Cocksfoot	5 lbs.
Lotus major	1 lb.
	17 lbs. per acre

Superphosphate—200 lbs. per acre.

Results have shown that for the quick establishment of pasture on this land, no legume or grass approaches Subterranean clover in the early stages of development.

There are indications, however, that Lotus major, White Dutch clover and Perennial Rye grass will all have a place in any pasture mixture sown some years after initial development, when the soil has become more fertile.

Clean Seed or "Burr."

In order to demonstrate the relative results from clean seed and "burr" seed, when sown on land without cultivation, clean seed was broadcast at the rate of 4 lbs. per acre which was calculated to supply the same amount of seed as that contained in the sample of "burr" used.

During the first season and also at the time of writing, there was no decisive difference between the growth of the area sown with clean seed and that sown with "burr." Seeding was carried out in mid-May.

Demonstration Plots on Mr. O. Bowles' farm, Waroona, to show relative merits clean subterranean clover seed and "burr" for sowing on uncultivated land. (Left: Seed in "Burr." Right: Clean Seed.)

As already pointed out in a previous article (Journal of Agriculture, March, 1929, page 171), equally as good results can be obtained from clean seed as from "burr," and with a number of definite advantages.

The use of clover seed in the "burr" is only recommended where the farmer has gathered from his own fields, and is thus certain that no undesirable weed seeds or pests are in evidence.

In this district, with its ample rainfall, 3 lbs. of clean seed are recommended when sowing on unploughed country.

VARIATION IN THE WEIGHT OF EGGS.

W. T. RICHARDSON,
Poultry Adviser.

Inheritance in poultry covers a multitude of factors, amongst which the grade of egg is one of the most important. It is only of recent years that size of egg has been receiving attention from poultry breeders, and any improvement obtained has been the result of selective breeding. The size of the egg being a recessive factor, selective breeding must be practised not only to improve the size of egg, but to maintain any improvement obtained, otherwise reversion to the small egg will follow, and years of good work may be wasted.

We generally breed from second season birds and over which, as a rule, lay larger eggs than birds in their first laying season—as a matter of fact the maximum size of egg is generally not reached till a hen is in its third season. In selecting eggs for incubation the common practice is to reject any eggs under two ounces in weight, and no doubt large numbers of such eggs are discarded. In principle this is quite the correct procedure, but in actual practice it leads nowhere. We hear from candid poultry farmers that, although they do not put an egg under two ounces in their incubators, their production of undersized eggs is excessive. Here is where inheritance comes in. What did their stud birds do in their first laying season, and what was the size of egg laid? If they laid small eggs, what can we expect their progeny to do but inherit the small egg factor from the parent stock? As for the sire, he may very likely be bred from a bird with similar characteristics to those of the hens he has been mated with and he, therefore, has not the power to help check the small egg propensity of his strain in his progeny.

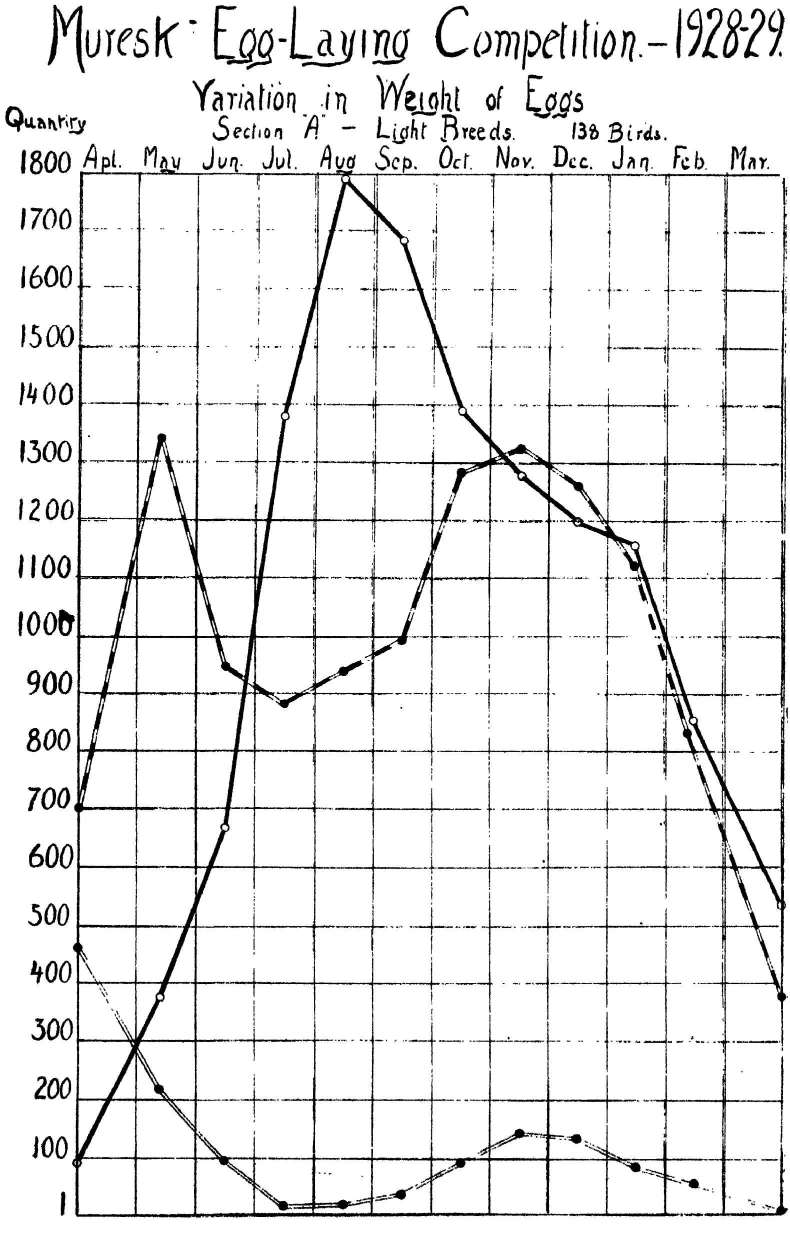
The main consideration when breeding for size of egg, and this should be the aim of all poultry farmers, large or small, is to know the performance of their prospective breeders in their first laying season, so that they may be rejected or kept for the following season's breeding operations according to their performance. This object cannot be attained unless a number of pullets are tested either in single pens or by trap nesting.

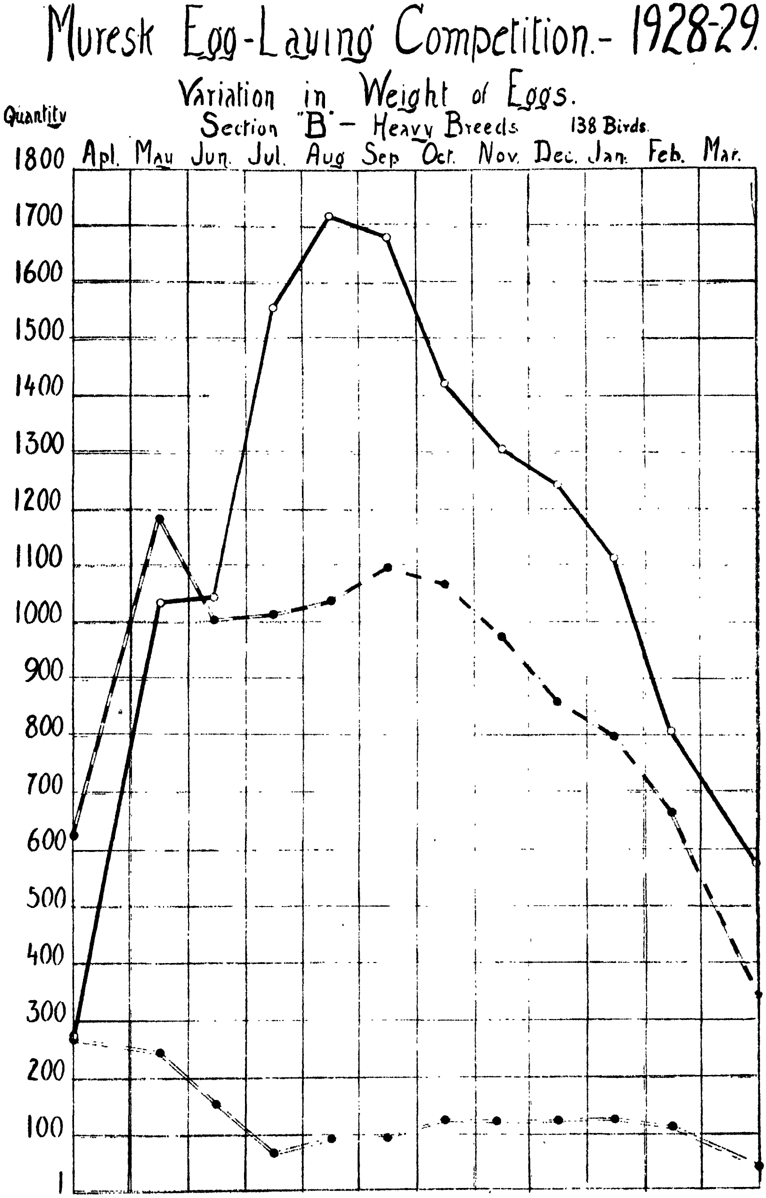
The variation in the size of eggs laid by individual birds throughout their first season is very pronounced, and has various tendencies, and only by testing our pullets can we learn our lesson.

The following graphs have been prepared and based on the results obtained at Muresk Egg Laying Competition, 1928-1929, in which a total of 276 birds were entered. One graph refers to Section "A," comprising 138 birds, all White Leghorns. The thick lines indicate two-ounce eggs and over; the black and white lines, eggs weighing under two ounces but not less than one and three-quarter ounces, and the double lines, eggs under one and three-quarter ounces. For the purpose of this article these shall be referred to as first, second, and third grade respectively. The marginal figures under the word "quantity" relate to the number of eggs laid, and the month during which they were laid is shown by the discs on the various broken lines.

We find that during April the 138 birds in question laid, in round figures, 90 first-grade eggs, 700 second-grade eggs, and 470 third-grade eggs. In May their performance was 375 first-grade eggs, 1,345 second-grade eggs, and 215 third-grade eggs, and so on.

A glance at the chart will show that after May, when the second and third grade eggs are declining rapidly, the number of first-grade eggs increases very considerably, with the result that in August we have the peak production of first grades. Then their numbers reduce, till in November more second grades than first grades are laid.





Graph No. 2 refers to Section "B," comprising 138 birds, *i.e.*, 132 Black Orpingtons and 6 Rhode Island Reds. Here again we see the same tendency, that is to say, an increase in the number of first-grade eggs, till the peak period (August) is reached, when their numbers decline rapidly.

The fluctuation in grades may be attributed by some to the influence of climatic conditions at Muresk. This, however, is not the case, because the same fluctuation has been noted every season in eggs submitted for export which are produced in a number of districts. August and early September produce a larger percentage of 16lb. packs than October and November.

On the other hand a number of birds carried a more uniform size of egg during the term of the test and, therefore, did not show any decline in first-grade eggs after August.

Table No. 1 gives a detailed performance of the winners of the competition in question, a team of six Black Orpingtons. None of these birds had commenced laying before their arrival at the Competition. Here we have five birds, consistent layers of first-grade eggs, and one bird (No. 94) following the general trend to decline in egg size after the noted peak period.

A few Black Orpingtons and White Leghorns are given in table No. 2, showing the individual decline in grade of egg after the August-September period.

Tables Nos. 3 and 4 have been prepared, giving in detail the range of the variation in weight of every egg laid by individual birds during the respective months of the Competition. The first one relates to a White Leghorn (No. 9) and the latter to a Black Orpington (No. 64). This is the general trend, more pronounced in some birds than in others.

The above graphs and charts clearly indicate that single testing without recording the weight of every egg laid is of little value to the breeder, as all he learns is that his birds laid a certain number of eggs with no indication of their grade. How can we breed for size of egg without having a detailed performance of our stud birds? Averages taken during given weighing periods will not help in that direction, as Tables 2, 3 and 4 readily demonstrate. Every day during the term of the Test should be part of the weighing period.

Only by single testing, recording the weight of every egg laid, discarding from our breeding operations birds as shown in table No. 2, and concentrating on those as detailed in table No. 1 (bird No. 94 excepted), shall we, after a few years of such breeding, relieve our markets of the large quantities of undersized eggs, which have a detrimental influence on the price of the product of the hen.

TABLE No. 1.

MURESK EGG-LAYING COMPETITION 1928-1929.

Grade of egg laid by the winning Team of six Black Orpingtons.

—	Bird No.	2ozs. and over.	1¾ ozs to under 2ozs.	under 1¾ ozs.	Bird No.	2ozs. and over.	1¾ ozs. to under 2ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.
April	91	...	...	...	92	...	...	...	93	...	2	...	94	1	3	1	95	...	...	...	96	7	2	...
May	...	17	1	...	...	16	4	...	...	19	1	...	...	5	20	...	...	14	3	...	...	16	...	...
June	...	23	1	...	...	23	...	...	...	15	...	...	...	10	13	...	...	17	...	...	...	7	...	...
July	...	21	...	...	...	19	...	...	...	21	...	...	...	14	6	...	...	20	...	...	...	18	...	...
August	...	22	...	...	...	8	...	...	...	20	...	...	...	10	10	...	...	22	...	...	...	13	...	...
September	...	20	...	...	...	17	2	...	...	23	...	...	...	19	2	...	...	22	...	...	...	19	...	...
October	...	24	...	...	...	21	...	...	...	20	...	...	...	5	7	...	...	18	...	...	...	25	...	...
November	...	19	...	...	...	21	...	...	...	21	...	...	...	5	14	2	...	23	...	1	...	23	...	...
December	...	22	...	...	...	18	...	...	...	20	...	...	...	2	10	1	...	20	...	1	...	21	...	...
January	...	8	...	...	...	11	1	...	...	20	...	...	...	2	1	...	...	7	...	...	...	21	...	...
February	...	20	...	...	...	10	...	...	...	17	...	...	...	...	6	3	...	17	...	1	...	13	...	...
March	...	12	...	...	...	4	...	...	...	11	...	...	...	5	2	...	...	10	...	...	...	11	...	...

TABLE No 2.

MURESK EGG-LAYING COMPETITION, 1928–1929.

Grade of Egg laid by Individual Birds.

—	Black Orpingtons.												White Leghorns											
	Bird No.	2 ozs. and over.	1¾ ozs. to under 2ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.	Bird No.	2 ozs. and over.	1¾ ozs. to under 2 ozs.	under 1¾ ozs.
April	118	5	4	...	107	...	2	...	89	6	5	3	47	1	11	1	78	1	1	1	56	...	1	...
May	...	4	19	...	...	20	...	...	...	14	8	...	...	10	10	...	...	...	6	2	...	2	6	...
June	...	13	3	...	...	18	1	...	...	22	...	...	...	16	2	...	...	7	4	...	...	1	moult	...
July	...	15	1	...	...	17	2	...	...	23	...	1	...	20	...	...	...	6	1	1	...	21	...	...
August	...	16	...	...	...	23	...	...	...	24	...	...	...	21	...	...	...	16	2	...	...	20	...	...
September	...	13	5	...	...	21	3	...	...	22	1	...	...	23	1	...	...	20	4	...	...	19	3	...
October	...	10	11	...	...	15	9	...	...	21	4	...	...	14	10	1	...	11	14	...	...	12	9	...
November	...	4	10	2	...	13	13	...	...	21	4	...	...	7	20	...	...	4	21	...	...	13	11	...
December	...	3	15	2	...	10	17	...	...	16	9	...	...	4	21	...	...	...	24	2	...	8	14	1
January	...	3	7	1	...	7	16	...	...	6	18	...	...	3	19	...	...	3	10	...	...	10	13	...
February	...	...	9	...	...	6	10	...	...	6	14	...	...	5	14	...	...	5	10	...	...	2	5	...
March	...	10	...	...	...	4	5	...	...	6	5	...	...	7	6	...	...	6	2	...	...	moult		

TABLE NO. 3.

MURESK EGG-LAYING COMPETITION, 1928–29.

BIRD NO. 9—WHITE LEGHORN.

Variation in Weight of Eggs laid.

—	Ounces to 1 dozen eggs.										
	Under 1¾ ozs.		= 1¾ ozs.			= 2 ozs.			= 2¼ ozs.		
	19	20	21	22	23	24	25	26	27	28	29
April	...	1	2	2	6	...	...	...	...	...	...
May	...	...	...	...	4	10	6	...	...	...	...
June	...	...	...	...	3	4	7	4	...	...	...
July	...	...	...	...	2	9	7	5	...	...	...
August	...	...	...	...	1	8	13	1	...	...	...
September	...	...	...	...	5	11	6	1	...	...	...
October	...	...	...	1	6	10	5	1	...	...	...
November	...	...	1	3	6	9	2	...	...	...	...
December	...	...	8	10	1	1	1	...	...	...	...
January	...	...	5	11	4	1	...	...	...	...	...
February	...	1	2	3	1	1	...	...	...	...	...
March	...	...	2	6	1	1	1	1	...	...	...

TABLE NO. 4.

MURESK EGG-LAYING COMPETITION, 1928–29.

BIRD NO. 64—BLACK ORPINGTON.

Variation in Weight of Eggs Laid.

—	Ounces to 1 dozen eggs.										
	Under 1¾ ozs.		= 1¾ ozs.			= 2 ozs.			= 2¼ ozs.		
	19	20	21	22	23	24	25	26	27	28	29
April	1	1	...	2	...	1	1	...	...	...	...
May	...	...	...	1	12	9	...	...	...	...	...
June	...	...	...	...	2	1	...	...	...	...	...
July	...	...	2	...	6	8	2	1	...	...	...
August	...	...	...	...	...	8	9	4	...	...	...
September	...	...	...	...	2	10	9	...	...	1	...
October	...	...	1	1	7	9	4	1	1	...	...
November	...	...	1	2	8	5	4	...	...	...	...
December	...	...	3	2	10	7	...	...	...	...	...
January	...	...	...	5	4	...	...	...	...	...	...
February	...	3	...	3	5	1	...	...	...	...	...
March	...	...	...	2	...	...	...	...	...	...	...

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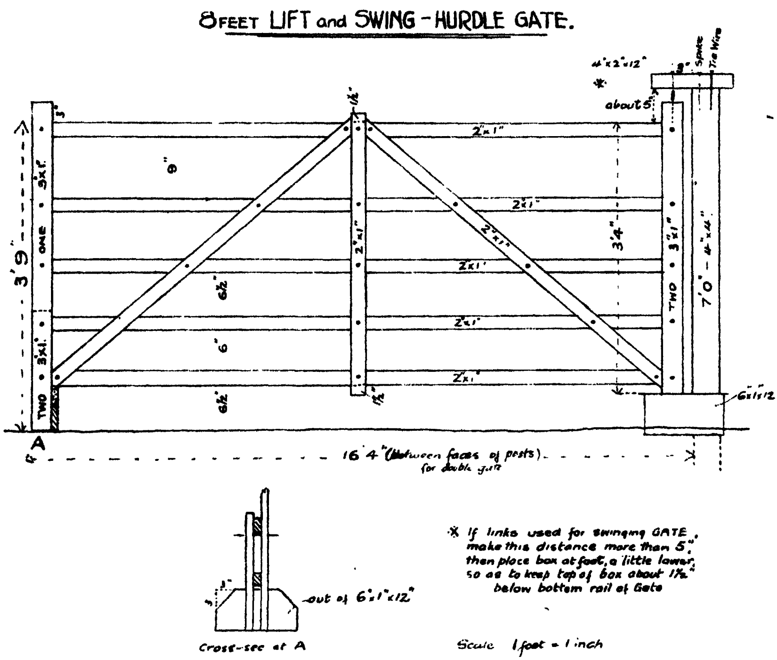
Cake Flour
Health Saline
Lemon Squash Cordial

4—4

A LIFT-AND-SWING HURDLE GATE.

While on a recent visit to the Gnowangerup district the writer had the opportunity of seeing a gate and a wire sheep-feeding trough, both of which appeared of sufficient interest to warrant bringing under the notice of readers of the "Journal of the Department of Agriculture." With this end in view photographs and details of these were obtained, and are submitted in the hope that they will prove of benefit to our farmers.

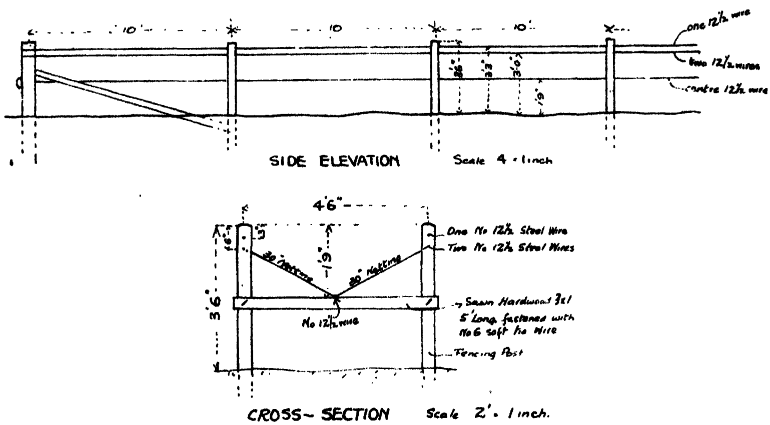


The gate is of very simple design and especially useful for openings where it is unnecessary to keep it continually closed. The two outstanding advantges are, firstly, the simplicity with which it is hung by means of a chain from a support on top of the post, and secondly, the foot attached to the meeting stile of the gate, which ensures it remaining open in whatever position it is placed. This useful pair, as illustrated, were seen on the holding of Messrs. R. Formby & Sons, Ltd., and grateful acknowledgments are due to Mr. R. Formby for the sketches supplied.

THE WIRE NET SHEEP-FEEDING TROUGH.

In view of the recognised advantages of supplementing the natural pasture during our summer months, the sheep-feeder illustrated herewith will be of particular interest, as it is suitable for feeding a large number of

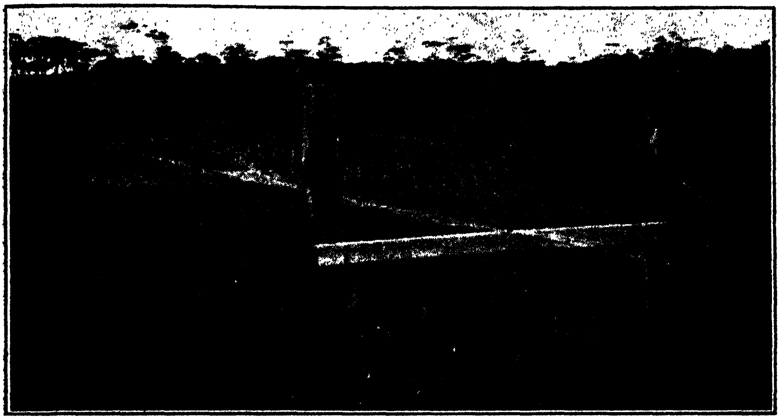
WIRE-NETTING SHEEP FEEDER — 150 FEET LONG.



sheep with a minimum of inconvenience to the stock, and without waste. By the use of this feeder, as will be seen, long hay can be fed, and the sheep are able to reach the hay from all sides and underneath without difficulty.

Wire Net Sheep Feeding Trough I.

A very considerable tonnage had been fed through this feeder and there was not seen any indication of waste around it. Particular attention is directed to the type of netting used, which after some experience and trial Mr. Formby



Wire Net Sheep Feeding Trough II.

found most suitable for the purpose. It is 14 gauge, 3in. mesh, and is known as boody-rat netting. Another point of note is the economic length, 50 yards, which is just sufficient to use up a 150ft. roll of netting.—*The Director.*

Lift-and-swing Hurdle Gate.

MARKET GARDEN HINTS.

E. T. MORGAN,

Vegetable Inspector.

Mistakes are common to mankind; this applies no less to the vegetable grower than to any other class of the community. Whilst visiting market gardens in the metropolitan area, I have met growers who have been doing what they thought the right thing, but who were doing it in quite the wrong way. In at least three instances I have seen growers liming land, then turning it over and planting seed, together with blood and bone manure and other nitrogenous fertilisers. If the action of lime is understood it will be realised that this is a great mistake. Lime should never be applied to soils together with manures containing sulphate of ammonia or blood and bone, as in these cases great losses in nitrogen occur; lime liberates the nitrogen contained in the mixture; it then passes into the air and is lost. If applying lime to soil, do so at least three or four weeks before the application of other fertilisers. The majority of growers are alive to the benefits to be derived by liming the land, and much more of it could be used than is at present.

While it is true that lime is one of the elements essential to plant growth, it is usually found in cultivated soils in sufficient quantities for direct plant feeding. The great benefit derived is through its action in releasing other forms of plant food, particularly potash, from the insoluble forms in which it occurs in the soil. Lime is also important in a soil containing large amounts of organic matter, as it corrects the acidity of such soils and enables nitrifying bacteria to thrive and do their work in bringing the nitrogen of organic matter into available form for direct plant feeding. Lime is also a preventive of the disease known as club root of the cabbage, turnip, etc., which occurs in acid soils.

Unfortunately lime has been found to bring about conditions that have been favourable to the organism that causes scab on potatoes, and while the resulting crop may be larger, the market value is reduced by reason of the scab. It would be advisable to lime land a year previous to planting potatoes. Lime lessens the cohesiveness of clay soils, and increases that of sandy soils; in fact there are few soils the mechanical texture of which is not improved by liming. Lime will never make poor land rich if regarded simply as a manure; but used aright, there is no means available to the man on the land that more efficiently aids in building up the productivity of the soil.

Recently a crop of potatoes came under my notice which appeared stunted and showed lack of vigour. Upon inquiry I found that these had received heavy dressings both of stable and artificial manure. The stable manure had been applied at the time of planting, and blood and bone fertiliser had been used as a top-dressing about a fortnight after the potato plants had appeared through the ground. As the phosphoric acid and nitrogen in this fertiliser are fairly slow acting and as top-dressing is applied for its stimulating effect on the crop, it will be seen that it quite failed to answer the purpose for which it was employed. Had the blood and bone been applied at the time of planting with sulphate of ammonia as a top-dressing at the period when the plants were showing through the ground, the results would have been much better. This has been proved out by a successive crop which was treated in this way.

It will often be noticed when harvesting carrots and parsnips that a number of them may be malformed or forked. This is invariably caused by too shallow cultivation and also by having sown the manure too close to the surface. If the land has been thoroughly and deeply cultivated, and the manure well worked into the soil, this will be corrected. The carrot and parsnip, when well grown, are deep rooted plants, and where the soil is at all hard it does not allow of proper root extension. If the fertiliser is deeply worked into the soil the root will tend to go down after it. The root hairs of plants have mouths and I think they must have noses too; it has been noticed that when a heap of stable manure has been placed at some distance from a fruit tree, when the manure has been removed, upon digging down, a mass of fibrous roots have been encountered, much more than on the opposite side of the tree. Hence the supposition that their noses enable them to scent the manure and to reach greedily after it. The same thing applies to deep rooted plants, and where the fertiliser is deeply placed the root will endeavour to reach it.

In tomato culture, growers are becoming more and more convinced of the necessity for some kind of trellising or support for the plants. Allowing plants to roam all over the ground with the attendant risk of attack by numerous insect and fungus pests is gradually giving way to some method of support for the plant. This enables the grower to thoroughly dust or spray the plants for the control of these pests, which is impossible when plants are trailing along the ground. The fruit is also much cleaner, as in case of rain tomatoes near or on the ground get soiled and have to be washed before being packed for market.

Dusting for the control of various pests is gaining favour amongst metropolitan growers, as it is claimed that one man can do about four acres in a day as against one acre or less with a knapsack spray pump, a great saving when attacks by insect pests are noticed.

A mistake often noted, in the case of root crops, is the need for greater thinning of the plants. The young plants come out of the ground, if fairly thickly sown, so close together that they necessarily compete with each other for space in which to spread their leaves and roots, and for water and plant nutrients. If some of the plants are not removed, leaf development will be hindered, roots will be small and twisted about each other and the crop unmarketable. The grower realises this and thins out, but quite a number of growers do not seem to like the idea of being too drastic in this direction, with the result that many of the roots are too small for sale, and these have in turn not allowed of the maximum growth of their brethren. Crowding of plants in the seed-bed for future transplanting is also not conducive to the best stand possible.

The writer was, on one occasion, shown two patches of cabbages, both planted out on the same day. One patch was planted from a bed in which the plants had been sown thinly in drills, and the other one from a seed bed in which the seed had been broadcast. Both seed beds were planted on the same day, and although the plants were of similar size when lifted, the difference in growth was phenomenal at the time of observation, and those planted from the drilled seed bed were easily three weeks in advance of the others as well as being much better quality. In the case of early cabbages, say about April or May, this may mean a big difference when prices are dropping. It certainly pays to give plants sufficient room to allow of their full development.

WAX SCALE.

(*Ceroplastes Ceriferus*, Anderson.)

By L. J. NEWMAN, F.E.S., Entomologist; B. A. O'CONNOR, B.Sc.Agr., Agricultural Adviser; and H. G. ANDREWARTHA, B.Sc.Agr., Agricultural Adviser.

Order—Hemiptera. *Family*—Coccidae. The Coccidae, to which the scales all belong, are a widely diversified group of insects. The word Coccids is derived from the Greek Kokkos, denoting a rich red dye, which was procured from a scale insect now known as *Kermes vermilio*. Later, this scale, as a source of dye, was overpowered by the discovery of the group of dye-producing scales known as the Cochineal insects.

Scale insects when introduced into a country without their natural checks, and where the climatic conditions are favourable, become very serious pests and injurious to vegetation. The milder temperate zones, such as our local climate, favour their increase.

Fortunately some species have only one generation per annum, and this condition applies locally to the Wax Scale.

Taking scales generally, they can be roughly divided into the following groups:—

1. Those which attack only deciduous plants or trees.
2. Those which attack evergreen plants or trees.
3. Those which live only on the bark.
4. Those which live both on bark and leaves.
5. Those covered with hard shields or scales.
6. Those covered or protected by a cottony or waxy secretion.
7. Those which are naked.

The Wax Scale comes under Groups 2-4 and 6.

Generally speaking, scale insects are hatched from eggs which are minute oval bodies of varying colours laid under the body of the female. In some few species, however, the eggs are hatched in the maternal abdomen, and the young produced alive. When first hatched or born, they appear as minute insects, oval in outline, the body flattened and indistinctly marked off from the head. The head is provided with a pair of minute eyes, antennae

and a delicate sucking apparatus, consisting chiefly of long fine threads. For some time after emerging from the eggs, they crawl about actively with their six legs, seeking for a suitable location on the food plant in which to insert their rostra or beaks. Having done this they at once commence to form the protective scale or covering over the body. In most species, once they have fixed themselves by their mouth parts to their host plant, they never again move from this position, where they live their lives through imbibing the plant sap. When finality of position is determined, it is usual for the female scale to shed its legs and antennæ, as it has no further use for them. In the case of the males, they go through a series of comparatively quick changes, emerging as fragile winged insects, equipped with antennæ, eyes, legs, and one pair of wings.

The males do little or no damage to the plants, and consequently can be overlooked from an economic point of view.

The females continue to grow, and finally reach maturity. Their bodies become filled with eggs which they lay under the scale covering, the parent dying soon after this act has been accomplished. There seems to be no other aim in life than the perpetuation of the species.

Coccids or scales naturally increase very rapidly, if permitted, owing to the large predominance of females. They are largely protected by the waxy tests with which they cover themselves, and which appear to render them more or less unpalatable to most insectivorous birds.

It would almost seem that nature had combined to assist these insects. There is, however, under natural balanced conditions, a very important check provided in the form of other minute insects, chalcid wasps, etc., which prey upon or live within the bodies of the scales, destroying vast numbers.

Parasitic fungi also play an important part in their control.

It is when these insects are introduced from other countries without their natural controls that we have to suffer seriously from their ravages, as they increase to plague form. Under such conditions, we are forced to take artificial measures for their suppression, keeping always in view the possibility of biological control.

The harm done by sucking insects is often not appreciated till it is too late. The scales may be observed on the tree or plant in considerable numbers; but as long as the tree shows no marked injury, the majority of people are inclined to believe that but little harm has been done. They appear to overlook the fact that a tree, in the same way as a human, may put forth every possible effort to sustain itself against the attack, and apparently succeed in doing so, only to collapse in the end. Every living scale, when established upon a plant, constitutes itself, so to speak, an automatic pump, drawing the vital fluids from the host plant by means of its hair-like beak. The amount insects are capable of drawing from a tree in this way is truly surprising.

This fact is illustrated by the showers of honey dew which many sucking insects give off. The strain upon a plant or tree by sap imbibing insects is greatest when the soil moisture content is at its lowest, and when

the greatest amount of transpiration is taking place through the leaves, which is during the months of January to March. Therefore, if a tree has to carry myriads of these insects, it stands to reason that the tree and its fruit will greatly suffer.

Another serious result which has to be reckoned with is the effect of the honey-dew given off. This sweet sticky secretion spreads over the leaves and fruit, preventing the normal respiration and development of the tree.

Then, following on the presence of this honey-dew, there always appears a black fungus growth, commonly known as Sooty Mould or fumagine (*Capnodium spp.*).

This grows upon the sticky secretion, and is in no way parasitic upon the plant. Indirectly, however, it does considerable harm, because it clogs up the leaf stomata or breathing pores, and covers the fruit with black smut. This entails considerable labour in the cleaning of the fruit before marketing, and the process of this cleaning injures the keeping qualities of the fruit.

Get rid of the scale, and if no Aphides are present, the black smut will disappear.

Associated with the damage due to the absorption of the plant juices by the scale, there often follows a killing of the plant cells, caused by the irritation excited by the beak of the insect, or by the injection of some toxic fluid.

Scales belong to the group of sap suckers or Haustellate insects. It follows, therefore, that the application of a poison foliage-spray such as arsenate of lead would be useless, as the food is drawn from beneath the surface of the leaves. Such insects can only be destroyed by a contact spray or fumigation. The action of a contact spray is to either destroy by a caustic effect, or by stuffing up the breathing spiracles, by varnishing or waxing over with an air-proof film.

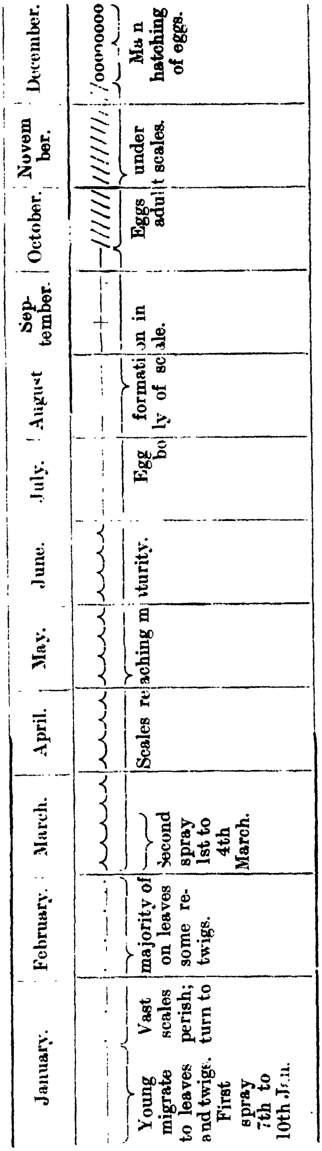
To be able to take effective and timely measures of control against the Wax Scale, we must have an intelligent appreciation of its life history and habits. To this end a careful and systematic study of the scale under local conditions, both in the field and laboratory, has been undertaken during the past 20 months.

The members of the Genus Ceroplastes are chiefly confined to the tropics. The Indian Wax Scale, the one under discussion, has become more or less cosmopolitan, and was introduced into Eastern Australia as far back as 1897. Its record in this State dates back to March, 1911, where it was discovered infesting a few citrus trees in the Kalamunda district. It was undoubtedly brought in on imported citrus trees from Eastern Australia.

Fortunately its spread has been very limited, being almost entirely confined to the same district in which it was first reported. In 1925 the district inspector discovered that a native plant known as *Sollya fusiformis* was carrying this scale. Since then an isolated outbreak has been reported on one or two other native plants such as the Ti-tree and Christmas tree.

Occasionally Apricot, Pear and Persimmon trees in proximity to infested citrus have been found slightly affected.

LIFE HISTORY.



The Eggs.—These are microscopic, oval, pinkish objects, measuring .32 m.m. or 1/70th of an inch long and .14 m.m. or 1/180th of an inch wide. (Block 1.)

Each female scale is capable of laying from 900 to 1,000 eggs, indicating its wonderful powers of reproduction.

In our observations over two seasons we have definitely proved that there is only one generation of eggs produced, but there is individual variation in egg development and hatching.

Some scales commence laying the first week in October, others at intervals throughout until the first week in December. All scales have deposited their eggs by the 7th December.

In taking these observations we found that before all the scales had laid, 30 per cent. of the first eggs laid had hatched, but were still living under the protection of the parent scale. For a period, the young scales, after hatching, remain under the mother, and appear to go through their first moult. The irregularity of the coming to the age of egg production accounts for the mistaken opinion that there are several generations in a year. Naturally, with a difference of two months between the laying of the first eggs and of the last, there will be a corresponding difference in the date of hatching. If, therefore, eggs which were laid during the first week of October, hatched during the first week in December, eggs which were not laid until the first week in December would probably not hatch until the first week in February.

Undoubtedly, the main issue takes place between the 20th December and the 7th January. The first treatment is, therefore, recommended to be applied on or about the 7th to 10th January. Those scales, which issue later, arise from eggs laid by a few belated females in December, which constitute a carry-over brood necessitating, if good control is desired, a second treatment at the end of February.

The Larvae.—The young naked six-legged wax scales were first observed to have issued from under the parent scales on the 20th December. These, in the main, crawl on to the leaves, where they select a temporary abode. Here they insert their rostra or beaks, and imbibe the plant juices. They at once commence to construct their typical waxy coverings. These are composed of a central oval covering, consistently surrounded by 13 delicate processes, four on each side, three on the posterior or hind end, and two on the anterior or head end, which gives them a very characteristic appearance. (Block 2.)

These young retain their legs, as three weeks to a month later, those that are living, migrate back to the young wood. Large numbers appear to die on the leaves, and in the process of returning from the leaves to the wood many are blown or fall to the ground, where they perish. (Block 3.)

It is doubtful if 10 per cent. of those which emerged finally settle down and reach maturity.

By the end of January the bulk of the scales have settled down into their permanent position on the young wood, shed their legs, and never

again move. About mid-February the shape of the waxy covering begins to alter. The dome-shaped central portion becomes pointed, giving somewhat the appearance of a clown's cap. (Block 4.)

Later, further pointed secretions of wax appear, which finally spread and form a complete covering, hiding the delicate processes seen during the first stage. (Block 5.)

All scales observed upon the tree are females, the male of the wax scale not having been discovered.

After reaching the adult stage the scales continue feeding and become fertile, eggs being developed in the maternal abdomen. This development of eggs continues for a period of three months. In mid-July, upon dissecting the scales, these eggs were discernible. From October and onwards to the first week in December, eggs are laid under the enveloping scale or waxy covering of the female, the parents dying when the young issue. (Block 6.)

The adult scale is about a quarter of an inch in diameter, formed of an irregular mass of wax, of a somewhat uniform pattern, slightly crimped on the edges and rounded on the top. The wax is at first almost pure white, but eventually becomes covered with dust and fumagine. The actual living coccid with the scale covering removed is top-shaped, rounded at the head, tapering to a point at the posterior. The under surface is flattened, and attached to the bark of the tree. In colour it is of a uniform dull red, and measures about 2½ lines or 1/5th inch in length. (Block 7.)

TREATMENT.

Owing to the nature of the scale's covering, which is formed of a waxy or greasy exudation, and which protects the otherwise defenceless body, it is difficult to destroy when in the adult stage. To obtain effective results by spraying, it is obvious that this must be done when the scale is in the young and defenceless stage, before the waxy test has been fully developed.

The fact that the citrus trees are evergreen renders spraying more difficult.

It also limits the strengths at which the various sprays can be applied without injury to the foliage. (Block 8.)

Times to Spray.—The careful study of the life history of this scale has revealed that the most vulnerable period is when the young have just issued. The main swarm comes forth between the 20th December and the 7th January; supplementary swarms occur between the 7th January and the end of February.

The most effective times, therefore, to spray are about the 7th to 10th January, and again at the end of February.

What to spray with.—If spraying is done at the periods advised, any good contact oil spray will prove effective. Oil sprays are not by any means as efficient as soda, if applied when the waxy covering is well formed.

The standard home spray, and one that probably gives the best general results, is that known as the washing soda solution. The formula recommended is ¾ to 1 lb. of washing soda to the gallon of water. If scale is very young, the ¾ lb. strength will prove effective. For more advanced scale use the 1 lb. strength. If preferred, soda ash may be used at half the washing soda proportion.

The action of the soda appears to be corrosive, eating away the wax and leaving the young coccid exposed and dead. In the use of the soda wash it is necessary to see that as little as possible of it reaches the ground, owing to its evil effect upon the chemical and physical condition of the soil, and its damaging effect to the roots.

Whatever the spray used, it is essential to see that the work is done thoroughly, care being taken to ensure that the inside of the trees as well as the outsides, and the under as well as the upper sides of the leaves are thoroughly coated.

In the use of any contact spray, it must be understood that it is only those insects which are brought into contact with the killing agent that are destroyed.

Experiments with various sprays during October were made, with the view of finding out whether a spring treatment before the eggs were laid would yield better results than spraying later in January and February, when the eggs had hatched.

The results were disappointing, the intense waxy covering then present offering too great a resistance. Further experiments in regard to times of spraying are to be conducted.

Biological control.—During our investigations it was found that a small percentage of the scales were attacked by the larvae of a chalcid wasp. The controlling effect was, however, negligible. So far we appear to lack any effective natural enemy.

Block 1.

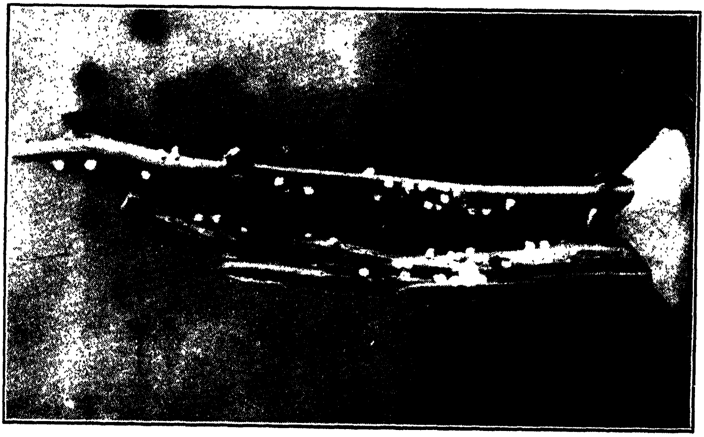
Eggs under parent scale. x 10. (Original.)

Block 2.

Typical young scale two weeks old. x 25. (Original.)

Block 3.

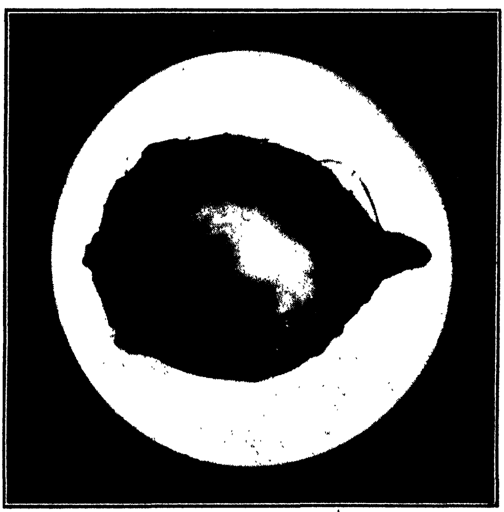
Young on leaf two weeks old. x 12. (Original.)



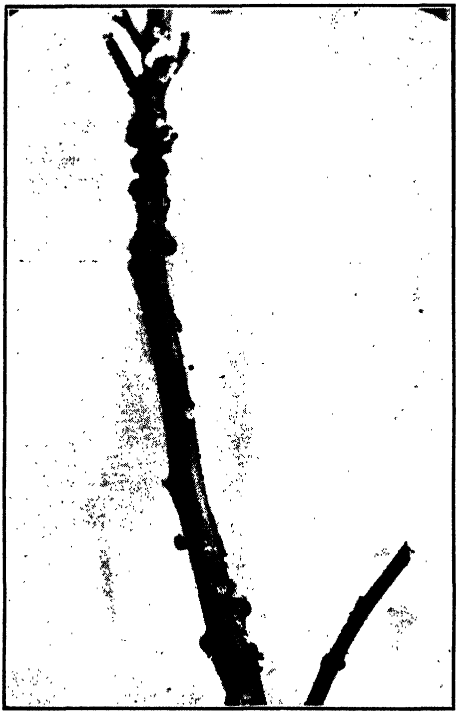
Block 4.
Twigs showing scale two months old.
(Natural size.) (Original.)

Block 5.
Scale 2½ months old.
Natural size. (Original.)

Block 6.
Full sized scale.
Natural size. (Original.)



Block 7.
Adult Coccid, with waxy covering removed.
x 12. (Original.)



Block 8.

Group of scales with wax removed.
Natural size. (Original.)

HORTICULTURAL NOTES.

GEO. W. WICKENS,
Superintendent of Horticulture.

The saying that "in the Spring a young man's fancy lightly turns to thoughts of love" may be paraphrased with reference to orchardists to read that "in the Spring the fruitgrower's fancy seriously turns to thoughts of what will the harvest be?" From the time when the buds commence to swell until the fruit is set constitutes a period of anxiety that only those who are intimately acquainted with the industry can adequately appreciate. So many things may occur—Thrips, Frost, Hail—to name only three out of many—changing a promising start into a bad finish. But the records of fruit crops for many years past show that while light crops alternate with heavy crops in the various seasons, a failure is unknown and two light crops in succeeding years is an extremely rare occurrence.

Last season stone fruits were under the average: this season in the majority of orchards there is a super-crop. Last season's pear crop was medium: this year it is from good to heavy. The apple crop last season constituted a record: this season it is light. The grape crop last season was good: this season it is again a good one. The citrus crop last season was under the average and present indications are that in the coming season the trees will yield plentifully, but it is too early yet to know what proportion of the young fruits now on the trees will shed and what remain to ripen.

The spring will have changed to summer by the time these notes are published and whether the crop be light, medium or heavy, fruit harvesting will then constitute the main occupation of fruitgrowers. To obtain the best results on the market great care should be exercised in grading and packing so that when any case is opened up the fruit in that case will be found to be of one size and quality.

The light crop of apples will mean a great reduction in the quantity exported compared with last season, but some shipments will be made and it is hoped last season's experience in the bad results attending the export of immature fruit will prevent any of that description being forwarded again, either in the coming or any subsequent season.

Though the winter rainfall this year was under the average in the fruitgrowing districts more than usual has fallen in November and cultivation to loosen the surface and prevent loss of moisture has needed constant attention, but the rain has been very beneficial in causing the trees to make strong growth and the orchards at the present time—November—are a beautiful study in green.

The abundant crop of early apricots will afford an excellent hopping off place for fruit flies this season, and growers should exercise the greatest care in destroying all infected fruits. All fallen fruit should be gathered up, not once or twice a week, but once in every 24 hours. By doing this and attending to baiting and trapping the pest will be kept

under control, but if neglect is shown in the early season's fruits the pest will increase, in a heavy stone fruit season like the present, to plague form by the time the mid-season fruit is fit for market.

No trace of Codlin Moth has been seen in the State since January last, and there is every reason to believe that Narrogin now as well as Collie has been freed from the pest, but all apple and pear growers must remember that it may be introduced in goods from the Eastern States at any time, and the Department should be notified at once if any fruit is found showing evidence of having been tunnelled by a caterpillar. If the pest is discovered in the early stages of invasion our experience has shown that it can be, and is, completely wiped out: but it would be a long fight with a doubtful issue if Codlin Moth had a few seasons' start in a district before steps for its eradication were taken. Western Australia is noted for the hearty co-operation of fruitgrowers and the Department in working for the benefit of the industry, and it is only this co-operation that has enabled Western Australian apple orchards to remain free from Codlin Moth.

STACKED LUCERNE HAY.

An interesting record of remarkable preservation of lucerne hay is given in the "Farmer and Settler" of the 4th October last, in which the writer points out as follows:—

> "When Mr. Andrew Phipps, of North Richmond, acquired his farm he stacked some hay. That was twenty-seven years ago, and there is about five tons of the fodder left. The stack is well roofed, but the sides are exposed to weather. After cutting in about six inches the other day the hay was found to be in perfect order—sound, sweet and green, and with leaf adhering to the stems. Mr. A. D. Playfair, Vice-President of the Royal Agricultural Society, who witnessed the cut, said that he had never seen a better lot of hay in his life."

"CONCRETE ON THE FARM."

(By Courtesy of the Swan Cement Company.)

Every day concrete is being more extensively adapted to all phases of our industrial life, and it is being more and more appreciated by the progressive farmer that by its use his work becomes easier and cleaner and increased production is the inevitable result. Farming is becoming more and more an exact science, and only good methods which will stand the test of time are considered as satisfactory to-day.

The strength of concrete can be made to suit all requirements, so that there is not a structure that could not use concrete, plain or steel reinforced, with advantage. Once a floor or wall is built in concrete it should be there for all time. Let us remind you that the old historical aqueducts built during the Roman Empire are standing to-day, a monument to the permanence of concrete—and there is no reason why the simple structures about the farm should not be just as sound and durable.

There is no great skill demanded. In fact, by following a few simple rules, any practical man can carry out a first-class job at the first attempt.

In addition to being strong, durable, and easily handled, concrete is quite a cheap form of construction. The only materials required in addition to the cement are sand, broken stone, and water. All of these can generally be obtained in the locality. The timber forming needed during the placing of the mass is recoverable and can always be used again elsewhere. Then, after the work is finished, it will cost nothing to keep the job maintained in perfect order and condition.

It is, in addition, proof against fire and weather, white ants and vermin, and may even be made proof against acids and other chemical reactions.

Of the many uses to which concrete may be applied, we suggest the paving of paths and yards, the floors to dairies and piggeries, the construction of water tanks, silos, troughs and bins, sheep and cattle dips, fence posts and drains, and a hundred and one other items too numerous to enumerate.

No better pavement can be put down in the stock yard or anywhere carrying heavy traffic. Mud and dust are entirely forgotten and a concrete pavement is readily cleaned down. Where water is plentiful it may be hosed down, and by having suitably arranged side gutters, the waste water is led away to a properly constructed cesspool or manure pit. Where water is not available, the pavement can be regularly swept down with a hard broom, and the rain depended on to wash it down occasionally. This hard sweeping or washing will never wear out the surface as it would with other pavements, and the result means that cleanliness is easily maintained, which must be reflected in the health and hardiness of the stock. It has furthermore been established that the manure recovered in this way is rich in plant food—much richer than that taken from the old-fashioned earth yard. Then, if it is led through concrete gutters to a well constructed pit, none is lost and the quantity recovered is naturally much greater.

Probably the dairyman has led the way in the use of concrete on the farm All up-to-date milking sheds have concrete floors, and many use in addition feed manger and alleyways constructed in the same material.

The dairy itself has a cement floor and the result is a sanitary condition, which protects the milk and the cream from spoiling, as was so often the case when the old earthen or wooden floors were in use. Moreover, the

quality and quantity of produce is much improved when the stock are well cared for, and it is recognised to-day that well constructed water tanks and troughs, stalls and mangers, and clean yards are essential if first-class condition is to be maintained in the herd.

Then the problem of the preservation and storage of fodder is answered by the use of concrete silos and bins. The elimination of wooden floors and walls to the barns goes a long way towards keeping down the mice and other vermin, and thereby saving a great deal of wastage and pollution of fodder that is so often met with. With the present high prices, every saving means money, and the thinking farmer cannot afford to overlook consideration of these facts.

CONCRETE.

(*What it is.*)

Concrete—a manufactured stone—is made by mixing together with water, Portland Cement sand and stone (or gravel). Various proportions are used, depending on the use to which the concrete is to be put. About an hour after mixing these materials together, the mass begins to stiffen, until, in from half a day to a day, it becomes so hard that you cannot dent it with the hand. By a month the mass is hard like stone—indeed, harder than most stones.

In large construction jobs, where great strength is required, the proportions of the mixture to be used is gone into very carefully so that the greatest strength can be obtained from the materials available. The greatest strength is obtained when there are little or no voids in the resulting concrete. This mixture is rarely obtained as the voids in each load of stone and sand vary a little, so in order to be absolutely safe it is as well to use a little more cement than will just fill the voids. For general work it has been found that a mixture containing 4 parts of stone, 2 parts of sand and 1 part of cement gives a very strong concrete—this is commonly called a 4 : 2 : 1 mix. In explanation of the term "voids" used above, the following may be of interest.

If we imagine a square box measuring 1 yard in every direction filled with broken stone, one can plainly see that however tightly we pack the stones in there will always be some empty spaces (or voids as they are termed) left between the stones. Methods have been devised whereby we can ascertain the volume of these spaces and thus obtain the volume of sand required to fill them up. It will be seen therefore that this quantity of sand can be put into our yard cube box *as well as* the broken stone. Likewise it will be seen that in the sand there are also a great number of smaller voids to be filled up and it is these spaces that have to be filled with cement which is ground extremely fine to fulfil this purpose. If then we ascertain the volume of the voids in the amount of sand required for our broken stone, we know the quantity of cement that will be required; and it will be seen that this cement *will also* go into the same box. Therefore, using a 4 : 2 : 1 mix, as mentioned previously, the following quantities would be required to make 4 cubic yards of concrete:—

4 cubic yards broken stone.
2 cubic yards sand.
1 cubic yard cement.

THE ESSENTIALS OF GOOD CONCRETE.

To obtain success in concrete work, the great essentials are:—

(1) that the materials be perfectly clean and sharp, the best of their respective kinds;

(2) that they be thoroughly mixed in proportions carefully determined, and

(3) that the cement be used fresh, or if it must be stored, that it be not exposed to the passage of moist air.

In fixing the quantity of materials required for a given job, calculate the cubical contents of the concrete work when completed and provide the same number of yards of stone. It will be found that the sand is absorbed without adding to the measurement, and it will also be found that wastings and leavings will about equal the bulk of cement that is afterwards added.

Materials for Concrete.

Before describing the actual process of mixing and placing concrete, it will be as well to have a clear understanding as to the nature of the materials to be used, and how these are best selected.

Portland Cement.

Cement is sent from the Factory in Bags, each bag contains approximately 125 lb. of cement, as 18 bags go to make up one ton.

It is important that the cement be stored in a dry place. Once wet it becomes hard and lumpy, and in this condition it is useless. If however, the lumps are caused by pressure in storing, the cement may be used with safety. Lumps thus formed can be easily broken by a blow from the back of the shovel. In storing cement, place a few wooden blocks on the floor and lay boards over them and then stack the cement on top of them, covering the pile with a tarpaulin. Never, in any circumstances, keep cement on the bare ground, or stack it directly against the outside walls of buildings.

Sand.

Do not use very fine sand. If there is a large quantity of fine sand handy, obtain a coarse sand and mix the two together in equal parts, this mixture is as good as coarse sand alone. Besides being coarse the sand should be clean and free from vegetable matter. The presence of dirt can generally be detected by rubbing a little on the palm of the hand. Another method is to fill a fruit jar to a depth of about 4 inches with sand and then fill to the top with water. After the jar is well shaken, the contents should be allowed to settle for about two hours. The sand will sink to the bottom, but the mud which can be easily recognised by its colour, will form a distinct layer on top of the sand. If the layer of mud is more than one half inch in thickness, the sand should not be used unless it is first washed. An easy method to wash sand is as follows: Build a loose platform about 10 to 15 feet long, with one end about a foot higher than the other. On the lower end and sides nail a piece of 6 x 2 timber on edge, so as to hold the sand. Spread the sand over this platform to a thickness of about 3 or 4 inches, and wash with hose. The washing should be started at the higher end and the water allowed to run through the sand and over the 6 x 2 piece of wood at the end.

Stone or Gravel.

This is known as the "coarse aggregate" of the concrete and care should be taken in its selection. The pebbles of gravel should be examined to see that there is no clay on their surface. The presence of a film of clay around the stones prevents the "binding" of the cement. If necessary the gravel can be washed in a similar manner to that described for sand.

The size of stone or gravel to be used will be governed by the form of construction contemplated. For foundations or any large structure anything from ½ inch to 2½ inch in diameter can be used. For thin walls, ¼ inch to 1 inch stones should be used.

Mixing.

The mixing of concrete should be thorough; this is as important as the proper proportioning of the concrete and the use of good materials. All ingredients should be carefully measured or weighed. A convenient form of measure for the sand and broken stone is a box without top or bottom, or a barrel with the bottom and top knocked out may be used. It is better to apportion the cement by weight, though the size of the measures used for the coarse material can be so adjusted as to permit a sack of the cement to be taken as the unit for that material. A wheelbarrow of known capacity is another unit of measure on small jobs. Water may be measured by a pail. To use a hose requires some little experience and care on the part of the person handling it, lest the Portland Cement and sand be washed away from the larger parts of the coarse material; moreover, the water cannot be measured by this method.

The concrete should be mixed as near to the place where it is to be used as practicable, for if left standing for any length of time it may set and become useless.

No concrete which has begun to set should be allowed to be beaten up and re-used under any circumstances whatever. Nevertheless, concrete that has begun to set may be treated as a coarse material if mixed with a fresh proportion of sand and Portland cement.

The measured materials should be spread out on a clean wooden bench, or stage, if the mixing is to be done by hand. If much mixing is to be done the stage should be covered with a thin piece of sheet iron or zinc plate. The sand should first be measured and then spread in a layer of even thickness.

The Portland Cement should next be distributed over the surface of the sand and the whole turned over dry with the shovel until the two materials are seen by the uniform colour to be thoroughly mixed. The coarse material should now be thrown over the mixture, and the whole turned at least three times dry and three times after wetting. It is better to add the water a little at a time until the right consistency is obtained, than that it should be thrown on all at once. The best manner in which to apply the water is by means of a rose-head to a watering can, which must be filled from the measured pails.

It is inadvisable to lay down any definite rule as to the percentage of water to be used in mixing concrete, owing to the varying conditions which obtain, such as weather and the nature of the coarse material and sand used in each particular case. The strength of plain concrete increases as the amount of water used in mixing is decreased, this being more particularly the case during the earlier stages of the maturing of the concrete.

Therefore, for mass concrete, it is usual to require that the quantity of water added to the other constituents shall be only just sufficient to bring water to the surface after thorough ramming, which ramming should make the mass quiver. In reinforced concrete, particularly in such portions as may contain a lage amount of reinforcing bars of the like placed closely together, it is essential that the concrete should be sufficiently wet to pass between the reinforcing bars and to thoroughly surround every portion of the steel, though not so wet as to allow any dripping of the cement, water and sand. This should be ensured at the expense of having the concrete wetter than would be otherwise desirable. Where the reinforcement is not very closely spaced it is unnecessary for the concrete to be so wet. In dry or hot weather, the quantity of water should be increased in order to allow for evaporation. Other conditions being the same, the drier the concrete the more quickly will it set and mature. This is of importance when there is any danger of green concrete being attacked by frost. The wetter the concrete, the greater is the tendency to contract during the process of setting and maturing.

Water.

Water for Concrete should be clean and free from strong acids or alkalies. If you are in doubt as to the purity of the water available, make up a small test block and see whether the cement "sets" properly.

It has been proposed by Lieut. Sankey, R.E., in "Engineering," that the following specification be made for concrete:—"The percentage of voids in the selected aggregate is to be found, and the sand and cement are to be added to make suffieinet mortar of the quality x sand to one cement to fill the voids + 20 per cent.—where x is the ratio of sand to cement."

The proportion of voids to the aggregate may be ascertained by filling a water-tight box of known dimensions with the material, and measuring the quantity of water poured in, so as to fill up the interstices. The amount of voids in 1 cubic yard of aggregate is given in the following table:—

	1 cubic yard contains voids amounting to
Stone broken to 2½-inch gauge	10 cubic feet
Stone broken to 2-inch gauge	10⅜ " "
Stone broken to 1½-inch gauge	11⅓ " "
River ballast (which contains the necessary sand)	4½ " "

Watch the Details.

The newly mixed concrete should be placed in the forms within thirty minutes after it is mixed. As it is being placed in the forms, it should be tamped or spaded. This operation makes the concrete dense and improves the surface.

Tamping.—The concrete is tamped in with a light rammer, or worked down with a small blunt spade to relieve any confined air, the spade being worked on the flat against the forms: this works back any large stones, and brings the matrix to the face, making a smooth job. In ramming, do not use a flat-face rammer of large area, it does not work the matrix through the aggregate.

Drying or Seasoning.

The forms should not be removed until the concrete has set. This will vary according to the dampness of the concrete and the weather. If there is no pressure, the forms may be removed in about twenty-four hours: but

in the case of a retaining wall, the forms should be left in position for three or four weeks on the side furthest from the bank. The concrete wall should be damped frequently to prevent too rapid drying, and the top of the wall should be covered with bags.

Protect and Cure Carefully.

Newly placed concrete should not be allowed to dry out. It should be protected from sun and drying winds or the water necessary for the proper hardening will evaporate, resulting in a loss of strength. Floors, walks, and similar surfaces can be protected by covering with moist earth, sand, hay or straw, as soon as the concrete has hardened sufficiently so that the surface will not be injured. This covering should remain for a week or ten days and be kept moist by occasional sprinkling.

CONSTRUCTION OF SOLID WALLS.

Frames or Moulds.

In building solid concrete walls *in situ* it is necessary to have movable forms or moulds. These are made of boards about one inch to 1½ inches thick—the boards should be well braced by stout cross-pieces, to prevent them bulging in the middle (due to the tamping down of the concrete).

There should be no cracks in the forms, or the concrete will ooze through and leave ribs on the wall, making the removal of forms difficult.

The inside faces of the moulds should be "greased" or "soft-soaped" before being put in position so as to render their removal easy from the face of the concrete. Moulds which consist of two wooden frames, as in the case of the short splash wall in the case of the dip, should be connected at intervals in the top by cleats.

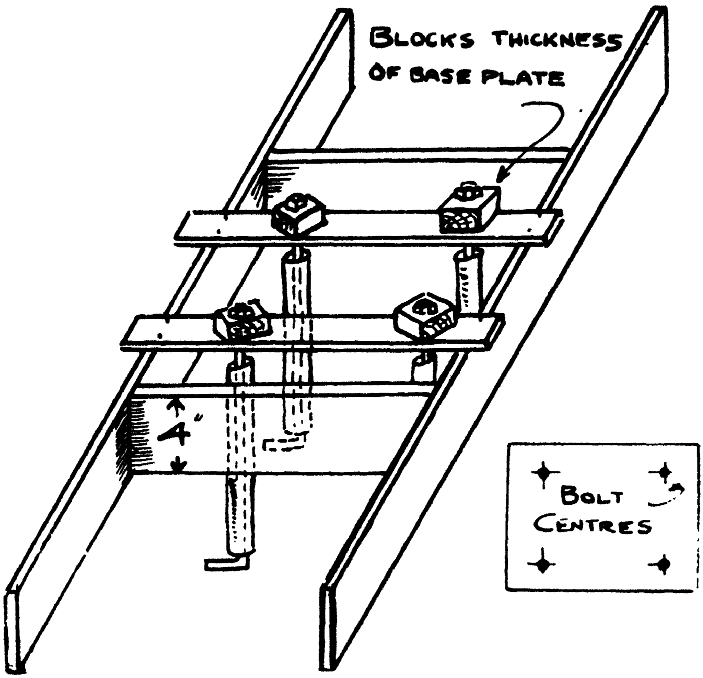
Reinforcing with Fencing Wire.

To strengthen a concrete building iron rods 5-16th inches or 3-18th inches in diameter are embedded in the walls. They are laid horizontally, and placed not more than 2 ft. apart. On small jobs, such as pighouses or sheds, old wire-netting or fencing wire could be used. The fencing-wire, being weaker than the iron rods, should be placed not more than nine or ten inches apart. The wire-netting should be cut into strips and doubled, so that the width of each strip is about two-thirds the thickness of the wall. These strips are laid flat and not more than nine or ten inches apart. The ends of all rods and fencing wire should be hooked.

Before undertaking concrete work, the farmer should be well equipped. A mixing-board on which to prepare the concrete is indispensable. A board 18 ft. by 9 ft. will give sufficient area to mix one cubic yard. This board can be made of hardwood flooring-boards, one inch thick and well cleated. For small quantities the ledge door of a stable could be used. A measuring box is also essential. A suitable size for this is 2 ft square and 2 ft. deep, giving a capacity of eight cubic feet. It has no bottom, and it should be strengthened with battens nailed on the outside, and be provided with double-ended handles. A watering-can with a fine rose is also needed. The quantity of water added to the mixture can be regulated with more certainty than when a hose is used, and there is no danger of washing out the cement. Square-mouthed shovels, a bucket to carry the concrete to the moulds, and a rammer made of 4 in. x 2 in. hardwood, three or four feet long are also required. Boards or moulds can be made of tongued and grooved flooring boards cleated together. Two feet is a suitable width for short moulds, but it will facilitate handling to make the longer moulds narrower.

CONCRETE FOR FOUNDATIONS FOR MACHINERY.

Engines, cream separators, Delco plants, pumps and other pieces of machinery require solid bases. These must be permanent and free from any vibration. A base constructed of concrete fulfils these requirements and is easily constructed. To form a base for the support of a small engine,



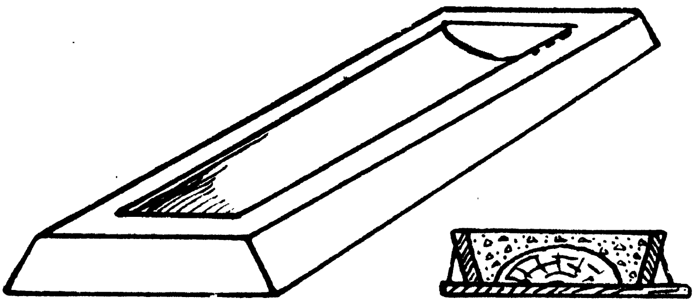
Wooden form for concrete foundation for machinery.

first excavate a pit two to three feet in depth (depending on the nature of the ground) and about a foot larger both in length and width than the dimensions of the engine base. Fix over this pit a wooden form to carry the concrete about 4 inches above the floor level. This form provides an easy means of locating the foundation bolts. Two strips of wood are nailed across the top of the form at the correct bolt centres and holes are drilled in same to accommodate the bolts. The bolts should extend into the concrete about a foot and should be bent over at right angles about 4 inches in length. Sufficient length of bolt should be left protruding from the concrete to allow for the thickness of the base plate and holding down nut. It is a good plan to enclose the bolts in gas pipe about twice the diameter of the bolt up to the concrete level. The open space formed around the bolt by the pipe allows for any slight errors in locating bolts or inequalities of castings. The pit and form can now be filled up with a concrete mixture containing 5 parts of stone, 2½ parts of sand and 1 part of cement. Keep the concrete wet for 24 hours after placing. After the en-

gine is adjusted on the base fill the spaces around the bolts with cement mortar mixed 1 part of cement to 1 part of sand. Do not start engine until the concrete has had sufficient time to harden up.

CONCRETE PIG TROUGH.

To construct a pig trough similar to the one shown below, make a box form the required size and place in the centre of it a half log as shown. The log should be about a foot shorter than the length of the box so as to allow about 6 inches of thickness at either end. A 4 : 2 : 1 mixture should be used, the largest size of stone being approximatey ¾in. in diameter. The



Concrete pig trough.

Box form with half log (end view).

trough is moulded upside down as shown and allowed to stand until the concrete has hardened up. In making concrete forms, much trouble can be avoided in removing the made article from the form by painting the interior of the form with common harvester oil before filling with concrete. As oil and grease will destroy green concrete, care must be taken to remove surplus oil before placing concrete.

CEMENT—SAND BUILDING BLOCKS.

The manufacture of Cement-Sand building blocks is a simple operation. Having a suitable block mould, certain proportions of sand and cement are mixed together with as little water as practicable and rammed well into the mould—the mould is then stripped from the block and the block set aside on a wooden or iron "pallet" to mature.

One of the most essential points to watch is that the sand used is clean and free from roots, clay and dust, etc., as these impurities stop the cement from setting properly.

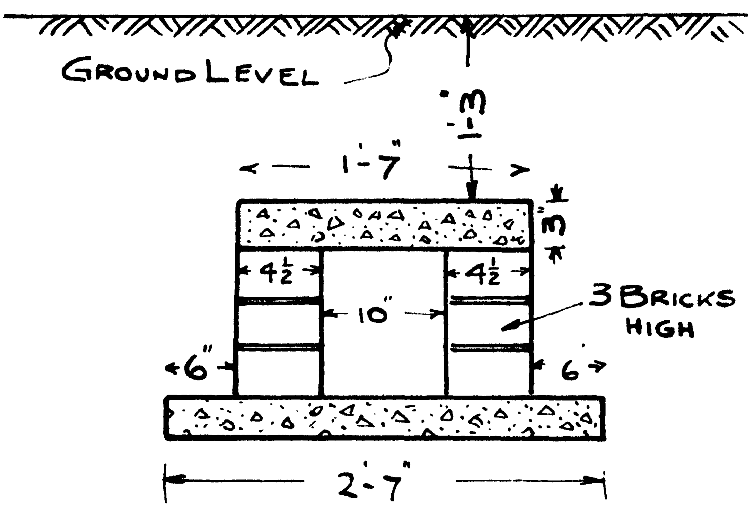
After the blocks have been made for a few hours, it is advisable to spray them with a fine spray of water so as to keep them damp—this spraying should continue at intervals for about a week, so that the blocks never get really dry—blocks so treated will show no tendency to crumble later on. Do not stack the blocks more than two or three high during the maturing period, otherwise the bottom row is apt to crack owing to weight being put on to the blocks before they have properly set. There are various types of block making machines and moulds on the market, ranging in price from about £3 to £50 or £60. For the average homebuilder one of the cheaper moulds is quite suitable, the more expensive types

generally being used or let out on hire by contractors. With these machines, of course, it is possible to turn out many more blocks per day than with the cheaper ones.

Various sizes of blocks are made, one of the cheaper moulds mentioned above makes blocks 18in. x 8in. x 6in. thick (with two cavities) for outside walls and 18in. x 8in. x 4in thick for inside walls.

The mixture of sand and cement advised for outside walls, is four parts of sand to one part of cement. One bag of cement will make about 22 blocks, using this mixture.

For inside walls, a mixture of five parts of sand to one part of cement can be used. One bag of cement will make about 30 such blocks. In calculating the number of bricks required it will be helpful to note that one block having a surface area of 18in. x 8in. equals 144 square inches, which equals one squae foot, thus a wall 10 feet by 12 feet in height would require 120 blocks, or one block for every square foot in the wall.



Small concrete culvert.

CULVERTS.

The question of conveying water under a roadway is a problem often met. The sketch above shows a useful sized culvert of inexpensive design. The concrete base should be taken to firm ground, no reinforcing bars are required in this slab. The top covering is made in slabs 18 inches long and put in position as soon as the brickwork is ready to receive it. These slabs should be reinforced with 3-8 inch diameter steel bars every 7 inches across and 3 bars placed longitudinally. The slab should be 4 to 5 inches thick. Care should be taken to consolidate the material on the outside walls after the slabs are put on, and if rammed hard to the level of the top of the slab, and then watered and left for a time, a further consolidation will take place, and the material can then be filled in to the ground level.

(To be continued.)

FERTILISER TRIALS AT SEAFORTH BOYS' HOME, GOSNELLS.

J. C. PALMER,
Dip. Agric., Potato Inspector.

This year a fertiliser trial was conducted in the Gosnells district. Through the courtesy of the Salvation Army authorities and Major Kemshall, suitable land was selected at the Seaforth Boys' Home. The standard "control" used in other portions of the State was again used against varying proportions of Nitrogen, Phosphoric Acid and Potash.

The land chosen for these trials was more or less typical of the soils to be found on river banks in the Armadale-Canning district. The soil varied from a red sandy loam to a heavier red loam, and had been under crops for some years and was rather infested with couch and other weeds.

Each fertiliser trial was conducted on a plot 2½ chains by 2ft. 6ins. wide and, consequently, each plot was 1/100 acre. Each trial was repeated six times and was so arranged that no two plots with the same manuring were adjacent to each other. The area chosen was divided up into six narrow lands to allow for adequate drainage, which unfortunately is too often neglected by growers in the winter plantings.

Certified Seed grown by Mr. F. Tonkin of Young's Siding was used, this having been selected from an 18-ton crop, and was cut into 2oz. sets. The cut sets were treated by the "Wet Bag" method. Planting took place on 4th July. The land was ploughed to a depth of about 7ins. and the sets were placed up the side of the furrow about 3in. from the bottom.

During the growing period, the plots were cultivated, hoed and ridged up. The first cultivation took place on 7th August. During the earlier portion of the growing period much dry weather was experienced, a factor which mitigated against a heavy crop. Later, the weather became somewhat unsettled and it was decided to spray with Schloesing's Prepared Bordeaux Mixture at the rate of 2lbs. per 15 gallons as a preventive of Irish Blight. The potatoes were well sprayed on 17th August. Finally the crop was dug in November, 4th-6th. During most of the growing period, the weather on the whole was on the dry side. The ground itself which sloped towards the river became very dry and powdery and did not appear to hold moisture too well. There was a crop growing in the land surrounding the trials. Exactly the same seed was used and was planted more or less about the same period. These potatoes, however, yielded much less than those on the experimental area. This may have been due to the fact that these other potatoes were neither sprayed nor side-dressed.

In these trials, the nitrogen was applied in two dressings, one half at the time of planting in the furrow and the other half as a side-dressing. The side-dressing was given when the plants were showing well in the rows. The reason for this method of applying the manure was that it was suspected that there might be a leaching out of the sulphate of ammonia in the drainage water of the soil. Sulphate of ammonia is readily soluble in water, and if there should be excessive rain much of it would be lost to the young plants. A comparative trial of this method against the custom of applying all the sulphate of ammonia in the furrow, was not made in this particular experiment. The crop grown round the trials was planted with exactly the same type of seed as that of the Departmental trials, but all the sulphate of ammonia was applied in the furrow. There was relatively a much higher yield in the Departmental trials than was obtained from the crop growing round it. Shortly before the side-dressing

was applied (a matter of 35 days after the planting of the crop) the young plants were showing well in the rows, but they were also showing the effect of too much dry weather. Rain fell freely after the application of the side-dressing. This gave the crop a filip and gave it such a start that it was standing up well when the potatoes all round the trials had "gone down." After the side-dressing, it was quite an easy matter to pick up by inspection the plots which had received no nitrogen in their manure. In the non-nitrogen rows, the plants were rather stunted and the leaves were yellowish.

Nitrogen Series.

Interesting results were obtained in the nitrogen series of these trials. Two variations of nitrogen, with the other constituents of the mixture remaining constant, were tested against the standard "Control" mixture. In all three mixtures there was 1,430 lbs. super and 210 lbs. sulphate of potash. The details of the quantities of nitrogen are shown in the table below:—

Sulphate of Ammonia per acre in lbs.	Lbs. of Nitrogen per acre.	Percentage of Nitrogen.
250	50	3
*500	100	6
0	0	0

* Control.

As the amount of nitrogen was increased from 0-100 lbs. per acre so the crop increased from 67 lbs. per plot (2 tons 19 cwts. 3 qrs. 8 lbs.) to 148 lbs. (6 tons 12 cwts. 0 qrs. 16 lbs.). The table below shows these figures.

Lbs. of Nitrogen per acre.	Yield in lbs. per Plot.	Yield in tons per acre.				Percentage Yield.
		T.	C.	Q.	lbs.	
50	116	5	3	2	8	78
*100	148	6	12	0	16	100
0	67	2	19	3	8	45

* Control.

A more detailed study of these figures shows a steady increase of crop as the quantity of sulphate of ammonia is increased. Further, that by applying approximately 5 cwt. of sulphate of ammonia per acre in two dressings, part at planting time and part as a side-dressing, an increased yield of 72 cwt. of potatoes was obtained over the crop grown without a nitrogenous fertiliser.

Phosphoric Acid Series.

The varying ratios of manure are indicated below, the fixed proportions were 50 lbs. sulphate of ammonia and 210 lbs. sulphate of potash.

Super. per acre in lbs.	Lbs. of Phosphoric Acid per acre.	Percentage of Phosphoric Acid.
1,668	350	15
*1,430	300	14
1,907	400	16

* Control.

In the table given below, it will be seen that by increasing the superphosphate from 1,430 lbs. per acre (300 lbs. phosphoric acid) to 1.668 lbs. (350 lbs. phosphoric acid), an increase of 13 cwt. per acre was obtained. When, however, the superphosphate was increased to 1,907 lbs. (400 lbs. phosphoric acid), there was found a diminished yield compared with that of the 1,668 lbs. application.

Lbs. of Phosphoric Acid per acre.	Yield in lbs. per Plot.	Yield in tons per acre.				Percentage Yield.
		T.	C.	Q.	lbs.	
350	145	6	9	1	26	112
*300	130	5	16	0	8	100
400	138	6	2	1	8	106

*Control.

Weighing up the yields from the plots.

The inference in this case is that an increase of superphosphate from 1,430 lbs. to 1,668 lbs. per acre is probably beneficial, but that 1,668 is probably the greatest amount of superphosphate which will give an increased yield on this type of soil. In this case, the application of an extra 2 cwt. over the quantity used in the "control" mixture of superphosphate in the mixture gave an increase of 13 cwt. of potatoes.

Potash Series.

The potash series did not show any outstanding results. As in the other trials, two variations of potash manures were used against the standard "control." These variations are tabulated below; the superphosphate and the sulphate of ammonia remained constant:—

Sulphate of Potash per acre in lbs.	Lbs. of Potash per acre.	Percentage Potash.
415	200	8
*210	100	5
0	0	0

* Control.

The table shown below would seem to indicate that no material benefit was derived by increasing the amount of potash from 0 lbs. per acre to 415 lbs., in this type of soil.

Lbs. of Potash per acre.	Yield in lbs. per Plot.	Yield in tons per acre.				Percentage Yield.
		T.	C.	Q.	lbs.	
200	136	6	1	1	20	98
*100	138	6	3	0	26	100
0	138	6	3	0	26	100

* Control.

From these results one would infer either that there was enough potash in the soil without any further addition, or else that in the earlier part of the season, which was very dry, little, if any, of the added potash was dissolved by the soil waters. In the latter case the potash manure added to the soil was not used at all by the crop.

Due to a short supply of Mr. Fred. Tonkin's seed, the seed used to plant the "buffer" rows was the progeny of his seed, which had been grown twice in the South-Western area, first in the winter crop and then in the summer planting. For the whole of the period during which these potatoes were grown in the South-West, they were under inspection by this Department. Further, for each planting the seed was selected carefully at the previous digging. This was to maintain, if possible, both the quality and the vigour of the seed. Thus these potatoes were of known strain and they had been looked after carefully during the time of growth in the South-West area. These potatoes were examined at the time of cutting and "Wet Bag" treatment, and appeared to be of a good type and of an excellent size and quality, though possibly not quite so forward in their sprouting as that seed obtained directly from the South. In both cases, however, the seed came directly or indirectly from the South and from the same grower in the South. In other words, both types of seed were from the same strain and both were treated in the same way. The only difference was that the seed used in the buffer rows had been grown twice in the South-Western districts.

It has been suspected that potatoes grown in the warmer potato regions are apt to become infected with mosaic and other virus diseases. For some while growers have found that there is a tendency for strains brought in from the Southern districts "to run out" and to yield less after cropping for some seasons in the South-Western areas. With this decrease in yield has been associated the growth of plants of dwarf growth and abnormal leaves. In other words, there is a certain amount of virus infection which must have been acquired, for the crops grown in the Southern area do not appear to suffer in this way to any extent. So that some idea of the amount of possible infection that might occur, the plants in the buffer rows were kept under observation.

Visible mosaic infection (that is to say, dwarfed plants with abnormal leaves) was noticed in the early stages of their growth. At a later count there was about 33 per cent. of visible mosaic infection, or one plant in four was infected with virus troubles. There is a probability that much more mosaic, more or less marked, was present. This was in marked contrast with the plants growing from seed brought directly from the Southern area, which showed little, if any, trace of visible mosaic infection.

A direct consequence of heavy virus infection is decreased yield. Thus from a consideration of the yield alone, without any reference to visible mosaic infection, these rows were in all probability heavily infected with virus trouble.

The potatoes grown from seed "twice" grown in the South-West were therefore much more affected with this trouble than those grown from seed directly obtained from the Southern area. The inference must be that during its period of growth in the South-Western areas the trouble must have been largely increased. This would seem to suggest that it is a wise policy for growers in the South-Western districts to bring their seed annually or at least biennially from Southern areas. In order to have the best possible seed, it would be better if seed were obtained from crops certified by the Department under the Seed Certification Scheme.

SUMMARY.

1. There seemed to be a general indication that when sulphate of ammonia is added in a manurial mixture, it is a good practice to apply some of the sulphate of ammonia in the furrow and the rest as a side-dressing, at least, in July and August planting.

2. In these trials is was found that 500 lbs. of sulphate of ammonia per acre gave an increased yield of crop more than proportionate to the cost of the manure.

3. There were indications that the application of superphosphate can be increased to 1,668 lbs. (approximately 16 cwt.) per acre.

4. The general "Control Mixture" used in all the Departmental Trials was found to be a very successful mixture in this type of soil. This mixture consists of approximately 14 parts of superphosphate, 5 parts of sulphate of ammonia and 2 parts of sulphate of potash, and is applied at the rate of 1 ton per acre.

5. Growers in the South-Western areas would be well advised to bring their seed from certified strains grown in the Southern areas biennially, or, better still, every year.

THE FARMERS' HANDBOOK.

A REVIEW. (EDITOR.)

We have received a copy of "The Farmers' Handbook," New South Wales, Fifth Edition, issued by direction of the Hon. H. V. C. Thornby, M.L.A., Minister for Agriculture, a publication which could profitably find a place in every farmer's library.

Primarily the work deals with the farm land districts of the parent State, and gives a succinct review of each division of territory concerned, as regards its topography, geology, soil classification and climate. Native timbers and their utility for various purposes is featured, while the cost of clearing the land and preparing for cultivation the areas described is detailed to the reader. This section also supplies information as to water ways, meteorological statistics, and agricultural, horticultural and pastoral production and potentialities, whilst the most up-to-date crop and rainfall map so far compiled is included in its pages.

There is found also a valuable treatise on the chemistry of the soil, embracing factors which determine fertility and causes of infertility, stressing the chemical composition of plant life and manurial values. These have of necessity particular application to the State of New South Wales, but embody much information concerning which no farmer can afford to remain ignorant.

Wheat culture; sheep on the farm; cereals; legumes and root crops; vegetable and miscellaneous crops, the last-mentioned including broom millet, sugarcane, Indian cane, Sudan grass, rape, kale and linseed, are all dealt with in an informative way.

Grasses and pastures will appeal to the pastoralist, but the subjects of particular value to the farmer of this State are to be found in silos and silage; the feeding of farm stock, including vitamines; feeding in relation to disease, and analyses of fodders.

A section devoted to "The Handy Man on the Farm" discusses harness; harness fitting and repairing; the use and care of rope; blacksmithing for farmers; tank making; carpentry; and painting on the farm, and provides interesting instruction which should reward any husbandman who secures a copy of this valuable publication.

Farm measurements and useful tables contrive to elucidate farmers' problems in relation to the measuring up of paddocks, stack building, dam sinking, and like employment, while instruction in book-keeping is imparted simply and effectively, and will be found not only of great interest, but of assistance in setting up and keeping a concise and correct record of profitable and unprofitable lines, detecting waste and leakage, and repairing errors in connection with financial undertakings.

The book generally forms a concretion of useful information such as men on the land require, and is necessarily of plural authorship, each having striven to vision the farmers' difficulties and interpret his needs with the object of distributing easily assimilated advice. In expression each has aimed at simplicity in the delivery of thought.

A number of the subjects with which it deals have from time to time been discussed in our own columns, but in a general sense the Farmers' Handbook collates all information, with a ready and excellent reference. It is issued by the Department of Agriculture, New South Wales, printed in clear type on good paper, is profusely illustrated, and may be obtained for the sum of 11s. 4d. per copy, which includes postage to any place within the Commonwealth.

"EARLY BLIGHT" OR "LEAF SPOT" AND THE MACROSPORIUM "STORAGE DISEASE" OF POTATOES.*

Caused by *Macrosporium solani* (Ellis and Martin), more commonly known as *Alternaria solani* (E. and M.) Jones and Grout.†

H. A. PITTMAN, B.Sc., Agr.,
Plant Pathologist.

The disease known variously as "Early Blight," "Black Spot," "Leaf Spot," "Target Spot," "Macrosporium Leaf Spot" or "Alternaria Leaf Spot" is found all over the world wherever potatoes are grown. It has been present for many years in Western Australia, but its depredations have never been taken very seriously, owing to the fact that it usually only occurs in epidemic form shortly before the tubers are harvested—and in consequence has never been considered capable of causing any great amount of loss. As will be seen later, however, its potentialities for destruction have, in the past, been grossly underestimated, and it behoves all growers in Western Australia from now on to regard this disease as one of the worst troubles with which they will have to contend. Particularly is this so in the case of growers of Certified Seed, on account of the serious deterioration which the fungus is capable of causing in the tubers after digging.

SYMPTOMS AND EFFECTS ON THE PLANTS.

In the field the disease may attack leaves, petioles or stems. (Fig. 1.) It is, however, most commonly found on the leaves, where it causes circular or irregular, dark-brown to almost black, dead areas, which often, on close examination, reveal a peculiar and characteristic zonation strongly suggesting a crude target or the contour lines on a map (see Fig. 3). The first spots commonly develop on the lower leaves. Under favourable circumstances each of the individual lesions may enlarge very rapidly, so as eventually to involve a very considerable portion of a leaflet, and when this is the case little or no zonation may be seen, as the zonation is an indication that the growth of the fungus has been relatively slow and spasmodic rather than swift and continuous. Lesions may coalesce where they meet, and in this way very extensive dead brown areas may be formed. Frequently, however, a large number of small, more or less concentrically-zoned areas will be found on each affected leaf. (Fig. 2.) Infection of a leaflet often takes place near the edge, and the dead area may then progress inwards in a wedge-like manner between several of the larger veins until the mid-rib of the leaf is reached. Infected leaves soon lose their normal green colour and become a pale green, or sickly yellow, between the diseased areas. The margins and tips of the leaves tend to roll upwards

* For information re "Rhizoctonia Scab," "Common Scab," and "Irish Blight," see the two preceding issues of this Journal, or reprints of same issued as Departmental Leaflets.

† As is a matter of common knowledge, there has been much argument and confusion in the literature as to the correct name for the fungus causing "Early Blight" of potato foliage. In the absence of any authoritative ruling on the matter, such as could be given by an International Conference of Mycologists, the original name is here being used.

towards the midribs, and the infected parts of the leaf may soon become so dry and brittle that they readily crack and crumble up if the leaf is vigorously blown about by the wind, handled, or knocked in passing. Breaks in the diseased tissue frequently occur in this way, and large areas of diseased tissue may fall out, giving the affected leaves a badly shot-holed appearance. (Fig. 3.) The stalks of diseased plants sometimes show dead brown areas due to attack by the *Macrosporium* and in such cases if the water supply to the top of the plant is thereby cut off, marked wilting and drying up of the plant above the directly-injured portion may result. Under conditions very favourable to the disease the plants may be destroyed as rapidly, and as completely, as by an epidemic of Irish Blight (9). Thus in the warm, moist, conditions of Bermuda the loss has been so rapid, and the lesions so large and indefinitely outlined, that considerable difficulty has at times been experienced in determining that the disease was due to *Macrosporium* without detailed laboratory examination. Under most circumstances in Western Australia, however, the disease does not reach its height until the vigour of the tops is starting to decline towards the end of the growing season. Nevertheless plants whose vigour has been prematurely reduced by the agency of some other parasite, or by some incompatibility between the plants and their inanimate environment, may be seriously attacked when the majority are but little affected. As the designation "Early Blight," has, however, in Western Australia, little aptness under most circumstances, it is proposed to refer to the disease hereafter as "Macrosporium Blight."

Loss of leaf tissue in the manner depicted above has a marked influence on the size and number of the tubers formed by the plants, as the leaf surface represents the factory space in which starches and other substances which go to fill up the tubers are formed. Hence any reduction in leaf surface means, at least, a concomitant reduction in yield. This is a point which might well be borne in mind by growers when endeavouring to belittle the damage done by the disease as an argument against preventive spraying.

HOST PLANTS.

Macrosporium solani is capable of attacking many other plants beside the potato. The only ones of interest to the potato growers of Western Australia are, however, the tomato, egg plant and common nightshade (*Solanum nigrum*). As shown by Folsom and Bonde (3, 4) and more latterly by Bonde (2), numerous, more or less indefinite, strains occur, some of which are much more virulent than others. Some of these strains attack foliage rather than tubers, some tubers rather than foliage, and some attack either indiscriminately.

LIFE HISTORY.

The life history of the fungus is very simple. Unlike many parasitic fungi only one type of spore (seed-body) is produced. These spores are very characteristic, being brownish in colour, blunt-nosed, long-tailed, and divided up into a number of separate cells by many transverse and occasional longitudinal walls (see Figs. 3 and 4). Most of the individual cells are capable under favourable circumstances of giving rise to an *infection thread* or *germ-tube,* so that the host has little chance of escaping infection if a spore happens to be blown or splashed onto a leaf or other plant part. (Fig. 4.) Under favourable conditions fairly large numbers of spores are

produced on the dead areas of the leaves. The spores are able to germinate, under ordinary weather conditions, as soon as they come in contact with moisture. (Fig. 4.) Infection may take place through the breathing-pores (*stomata*) on the leaves, or directly through the epidermal walls or insect injuries. New spots on the leaves, etc., may develop within 48-72 hours of inoculation, while spore production usually occurs within 3-4 days.

The source of the fungus-material (*inoculum*) for the first infections of the season is supposed to be overwintered spores,—new spores from fungus threads overwintering in potato remains in the soil, or from infected tubers.

In artificial culture the fungus frequently shows little inclination to spore, unless the medium is lacerated and allowed to dry out gradually in the sunlight (8), but in nature the production of spores appears to offer little difficulty. According to Rands (7), optimum spore production in the field is dependent on frequent rains, aided by heavy dews. High temperatures unfavourable to the potato plant, combined with sufficient moisture to ensure maximum spore formation, cause the disease to spread most rapidly —whereas droughty periods check its spread and seriousness. *Epidemics are likely to occur if high temperatures are associated with frequent moist periods and the plants are in a somewhat weakened condition.* For this reason "Macrosporium Blight" is most frequently found here in serious form after the commencement of the early autumn rains, towards the end of the growing period of the "summer" crops grown on the drained swamps such as at Benger. These crops are normally but little attacked prior to the commencement of the autumn rains, on account of the high temperatures and low humidity of the atmosphere during the preceding part of the growing period.

STRAINS OF MACROSPORIUM SOLANI.

Folsom and Bonde (3, 4) and more recently Bonde (2) working in Florida and Maine, U.S.A., have shown that the fungus, as isolated from potato tubers, consists of a number of more or less ill-defined strains, varying in spore dimensions, appearance of the colonies, abundance of spore production, frequency of mutations, rapidity of growth, stability of type, pathogenicity on leaves and tubers, and pigmentation of the potato-dextrose-agar medium. Some strains attack leaves mostly, others chiefly tubers, while still others appear able to attack either with equal readiness. The same variation in the species as indicated by chromogenicity, appearance, stability of type, rapidity of growth and pathogenicity on tubers has been observed in the present preliminary investigations. No tests have been made as to pathogenicity on leaves.*

MACROSPORIUM SOLANI AS A CAUSE OF TUBER-ROTTING.

For very many years after it had been demonstrated that *Macrosporium solani* was the cause of the "Early Blight" disease of the foliage, it was the common belief, and was emphatically stated in the text-books that the

* The present investigations are not by any means complete; nevertheless it has seemed desirable at this stage to acquaint the growers with the cause of the very troublesome "Storage Disease" and its most salient characteristics, so that they may be in a position to take steps to combat the trouble during the forthcoming "Summer" crop. Full experimental details will be published later.—H.A.P.

fungus could not attack potato tubers. In 1925, however, Folsom and Bonde (3, 4) proved conclusively that *Macrosporium solani* was the cause of a rather serious tuber-rot in the State of Maine, U.S.A., and especially in tubers, quite healthy when dug, on being opened up by the purchasers after railway transport from Maine to Florida. They showed that infection could take place through lenticels, wounds or eyes. The symptoms as described on Spaulding Rose tubers by them were as follows:—

> "The spots or lesions usually are darker than the healthy skin and appear somewhat sunken, sometimes surrounded by a slightly raised border. Their outline may be circular or irregular. The lesions are nearly always shallow and small, rarely exceeding a centimetre in diameter, and the transition from diseased to healthy cortical tissue often is abrupt enough that it is easy to lift out the infected portions intact. Apparently the invasion of new tissue by the parasite often ceases, and is slow when it continues after the first stage . . . . . *In the late summer of 1924, diseased Irish Cobbler foliage and somewhat immature Spaulding Rose tubers were packed together at various times. Usually abundant lesions resulted. When controls consisted of tubers not packed in the leaves no infection occurred.** Sometimes such a control was divided after infection had occurred in the corresponding inoculated tubers, and part of the control was inoculated in the same way, with similar positive results. *When well-sprayed, comparatively healthy foliage was packed with the tubers, only a few lesions appeared.* All platings from lesions soon after their appearance yielded pure cultures of *Alternaria solani.* These results suggest the possibility of infection of freshly-dug tubers from contact with diseased foliage. In Maine, digging is necessarily often done before the vines are all dead, or within a few days after the vines have been killed, wholly or in part, by low temperature. The death of the vines in the former case may be hastened by early blight. *Therefore diseased foliage often comes into contact with freshly-dug, somewhat immature tubers, which are more or less bruised by the time they are put into storage.*"

The latter part of the above extract is particularly interesting, in as much as there is obviously a striking parallel between the conditions under which the potatoes are often dug in Maine and in Western Australia. With us, the sudden onset of the heavy autumn or winter rains after the dry weather of the preceding part of the growing period of the "summer" crop, planted about January, frequently necessitates the tubers being dug very hurriedly and therefore somewhat immature. This is owing to the danger of rapid flooding of the rich swamp lands which are every winter and spring under water. With the onset of the rainy season there is frequently a heavy infestation of the foliage with "Early Blight," and by the time the majority of the crops are harvested conditions are such that the more or less immature, skin-rubbed tubers frequently undergo a veritable "baptism of spores." Consequently it would be rather remarkable, in view of the work of Folsom and Bonde (3, 4), if a certain amount of tuber-rotting was not experienced here during the winter in our stored potatoes, provided always that the variety grown ("Delaware") were susceptible.

As a matter of fact, a very serious deterioration in potatoes harvested in the autumn, and stored in open storage during the winter months of

* The italics throughout this quotation are mine.—H.A.P.

the year, has been taking place here for many years and has long been known by the growers as "Storage Disease." In some seasons as many as 30 per cent. of the tubers in open storage have been affected. The cause of the disease has never been determined, and potato growers and agents have resigned themselves more or less philosophically to what they have regarded as an inevitable but variable source of loss. (See Figs. 5-11.)

Shortly after the appointment of the writer to the position of Plant Pathologist in March of the present year, the disease became so serious, especially in connection with certain lots of Certified Seed, that it was felt that a determined effort would have to be made to ascertain the cause of the trouble. Consequently when the active work on the Bitter Pit investigations, which are being carried out in co-operation with the Council for Scientific and Industrial Research, slackened off for the year, an attempt was made to isolate possible pathogens. A large number of isolations were made with the result that the peculiar agar-yellowing and -reddening mycelium of *Macrosporium solani* was readily obtained. In addition, *Fusarium* (?) *oxysporum* and several species of bacteria were obtained from a few of the isolations. In no single case, however, was the *Macrosporium* not obtained, and in every case where an isolation was made from the edge of a lesion only the *Macrosporium* resulted—the *Fusarium* and bacteria only being obtained from the older, secondarily-infected parts of the lesions.

For some time following the isolations the identity of the *Macrosporium* could not be determined definitely, owing to its disinclination to fruit, but on partial drying-out the petri-dish cultures fruited rather abundantly in places, especially where the agar had been disturbed, or on the old piece of agar used to transfer the culture onto a new plate. Subsequently spores have been abundantly obtained in petri-dish culture after the agar has been lacerated, and the cultures allowed to partially dry out in the sunlight as recommended by Rands (8). As in the work of Folsom and Bonde (3, 4) and Bonde (2) chromogenic, non-chromogenic and variably-chromogenic strains were isolated. Inoculation and re-isolation experiments both with spores and mycelium have demonstrated that *Macrosporium solani* is the cause of the disease.

Mr. G. Samuel, Plant Pathologist to the Waite Agricultural Research Institute, Adelaide, South Australia, to whom a specimen of diseased tuber had been submitted, and to whom I am greatly indebted for much assistance in providing literature, etc., unavailable in Western Australia, replied as follows:—" . . . . I was interested to find on making cultures that the fungus present was *Macrosporium solani*." Subsequently Mr. D. B. Adam, Plant Pathologist, Department of Agriculture, Victoria, in correspondence with this Department re "Storage Disease" advised, "It happens that this year we had our attention drawn to a similar, if not identical, spotting of potatoes in this State. Indeed the matter was under investigation at the time of the receipt of your letter. At present, as the result of cultural studies and inoculation tests, I am confident that the spotting in the tubers submitted is due to the same fungus, viz., *Alternaria solani*, as is responsible for the Early Blight disease of the foliage. Actually, in some districts, last year was a bad year for this disease in the foliage of our crops and it was the first year in which there was an appreciable number of these black, sunken marks on the surface of potato tubers."

VARIETIES ATTACKED.

The American writers (3-6) have so far found the disease on Spaulding Rose, Early Rose, Irish Cobbler, Green Mountain, Bliss Triumph and Smooth Rural. In Western Australia it has only been found on two varieties, viz.: "Manistee" imported from Victoria, and "Delaware," which is the only variety grown locally on a large commercial scale. At this point it may be of interest to readers in other States or countries to remark that, unlike most potato-growing countries, only one variety has been cultivated here at all largely. This is a large, white-skinned and white-fleshed, quick-growing, early-maturing variety apparently identical with, or a strain of the American "Delaware" as described in U.S.A. Department of Agriculture Bulletin No. 176, "Group Classification and Varietal Descriptions of some American Potatoes," by W. Stuart, published in 1915. The general shape is variable, short and round, or quite as frequently with us long and rather much flattened, according to the district and soil conditions under which it is grown. It takes about three months from date of emergence to mature a crop in the summer time and about four months when grown in the winter. The white skin has a very marked tendency to rub off, exposing the flesh of the tuber, if dug, as is frequently the case, somewhat immature.

DESCRIPTION OF THE MACROSPORIUM SOLANI STORAGE DISEASE ON THE TUBERS.

Unlike the relatively small lesions found by Folsom and Bonde (3, 4), Gratz (5), and Gratz and Bonde (6) on American tubers, the lesions of the "Delaware" in Western Australia are for the most part externally very large. (Figs. 5, 6, 7, and 10.) The American writers appear to have recorded no lesions larger than about 2 cms. in diameter. With us, however, it is not at all infrequent to find one quarter to one third of the area of both sides of a tuber affected in a single lesion. (Figs. 6 and 9.) As the "Delaware" tubers when grown on our rich, peaty, drained-swamp lands are not infrequently nine inches or so in length by about four inches or more in width, the size of many of the lesions can be readily imagined. Smaller lesions, of course, also occur, and when infected tubers are carefully examined it is generally found that the larger lesions have originated at a place where a very considerable area of skin had previously been rubbed away, while the smaller lesions are usually the result of *lenticel* (breathing-pore) infections. The lesions are in all cases sharply depressed—darker in colour than the healthy skin, often quite glossy, and sharply marked off from the neighbouring healthy tissues. They may or may not be surrounded by a raised margin. Frequently the lesions have a gun-metal-like sheen, but sometimes they are of a dull brown or blackish hue. Very large lesions may be interrupted, here and there, by ridges, promontories, or islands of healthy tissue. (Fig. 6.) The lesions are quite unlike those caused by any other disease present in Western Australia. They are usually more or less circular where they have originated as a result of lenticel infections, but where the parasite has gained entrance to the tuber as a result of the rubbing-away of skin during harvesting, the lesions may be very irregular and are of no constant or characteristic shape. The fungus induces a comparatively slow, progressive dry-rot of a very characteristic type. Thus on cutting, very dry, brown or blackish areas will be found in the flesh immediately below the surface depressions. In proportion to the depth of the surface depressions and the surface area

of the lesions, the internal depth of discoloured tissue is often surprisingly small (see Fig. 10) and it is usually fairly sharply marked off from the adjoining healthy flesh. In the majority of the tubers so far examined the dead tissue of the flesh has varied from one-eighth to one-half an inch in depth. Observation and inoculation experiments still in progress indicate that the fungus attacks the flesh with most rapidity shortly after the commencement of infection, and thereafter, as the age and maturity of the tubers increases up to a point, the rate of attack gradually falls off. Thus tubers taken out of open storage bady infected, five to seven weeks after being dug immature, have been subsequently kept under observation at room temperature for many weeks without the lesions becoming very much larger, except where secondary infection with *Fusarium spp.* or bacteria has occurred.

In the later stages of the disease, however, secondary infection by bacteria and *Fusarium oxysporum* is common (Fig. 11), and in this case more or less complete destruction of the still healthy flesh speedily ensues. As no tubers have ever been found infected with "Storage Disease" at digging time, either here or elsewhere, infection presumably takes place during digging, from the spores produced on the "Macrosporium Blight" lesions on the leaves.

SUMMARY OF SALIENT FEATURES REGARDING THE MACROSPORIUM STORAGE DISEASE.

As a result of the experience of Potato Inspectors of this Department during a considerable period of years, and of infection experiments already carried out and still in process of being carried out by the writer, together with the findings of the American workers, the following statements may be made with a considerable degree of assurance as to their correctness.

1. Serious loss in stored potatoes from the Macrosporium solani Storage Disease is likely to follow an epidemic of "Macrosporium Blight" on the foliage late in the season shortly before the "summer" crop tubers are dug.

2. Infection of the tubers takes place during digging time from the spores produced on the "Macrosporium Blight" lesions on the leaves.

3. The Storage Disease is to all intents and purposes a disease of tubers dug in an immature condition. Potatoes dug when properly matured and after the skins are properly hardened are either not attacked, or if attacked only develop small, unimportant lesions.

4. The fungus is able to enter the tissues either through lenticels (breathing pores), eyes, or through places where the skin has been rubbed away during the digging and bagging operations. The latter condition is by far the most important, and accounts for the relatively enormous lesions commonly found here after only a few weeks in open storage.

5. Storage Disease works much more rapidly at relatively low temperatures than at high temperatures. In the experiments so far carried out here very serious lesions rapidly developed at room temperatures, 50-60 degrees F., but in the incubator at a temperature of 77 degrees F., very little, if any, infection or subsequent development took place.

American experiments showed that, with the varieties worked upon, infection and increase in the size of the lesions took place most rapidly at temperatures between 55 degrees and 60 degrees F., but no infection occurred below 41 degrees F. or above 77 degrees F. (6).

CONTROL OF "EARLY BLIGHT" AND "STORAGE DISEASE."

From what has already been said it appears that the following control methods will have to be taken by growers desirous of avoiding reduction in yield and subsequent deterioration of the tubers in storage. Especially is it important that the growers of Certified Seed do all they possibly can to prevent the development of "Storage Disease," since this defect can not be lightly regarded in connection with such seed.

1. **Preventive spraying of the foliage with Bordeaux mixture 4-4-50, or dusting with a recognised copper carbonate-sulphur dust should be carried out as a routine practice.** As is the case with Irish Blight," "Macrosporium Blight" can be readily prevented by spraying with Bordeaux mixture. The mixture should be applied with considerable force to both sides of the leaves, and every care should be taken to thoroughly spray the lower leaves as these are frequently the first attacked. If the commercial powder is used, mix one pound to six gallons of water. Past experience indicates that in most districts one thorough spraying (or dusting) towards the end of the season may be sufficient to prevent the epidemic which so often occurs prior to digging time. More frequent treatment may, however, be required if the weather conditions of the season are unusually favourable to the occurrence of the disease on the leaves. It is realised that the average grower may not take kindly to the idea of spraying his potato fields as a preventive measure against "Macrosporium Blight," owing to the fact that the great rarity of epidemics of "Irish Blight" here has never forced the grower to adopt routine spraying with fungicides. Nevertheless a condition of affairs now exists where either spraying or the use of appropriate copper carbonate-sulphur dusts will have to be resorted to as the only satisfactory way out of the difficulty. **If the disease is prevented from appearing on the foliage no infection of the tubers can result as there is no other source of spores. Spraying is more effective than dusting.**

2. If possible, **the tubers should never be dug until the tops have died down naturally and the potatoes have properly matured in the ground, as Storage Disease is essentially a disease of tubers dug immature.**

3. If the tubers must, of necessity, be dug immature, on account of the danger of flooding of the land before they could otherwise be harvested, or for any other reason, and the tops are badly affected with "Macrosporium Blight," every attempt should be made to first spray the foliage and soil with Bordeaux mixture to destroy as many of the spores as possible.

4. If it is not possible to spray with Bordeaux mixture before digging when the tops are badly affected with "Macrosporium Blight," and the tubers must be dug immature on account of the danger of flooding, etc., every attempt should be made to have the tubers sold and consumed within as short a period after harvesting as possible.

5. **Every possible care should be taken during the digging and bagging of the tubers to cause as little skin-rubbing as possible, as the most serious lesions invariably develop at places where the skin has been rubbed away during these operations.**

6. **Leaves and stems of potato plants should never on any account be placed in the tops of the potato bags owing to the great danger of copiously inoculating the freshly-dug tubers with the spores of the Macrosporium.**

7. Tubers should be stored, if possible, below 41 degrees F. so as to inhibit the development of the disease.

8. Potatoes affected with "Storage Disease" should not be used for seed purposes unless sufficient others cannot be obtained. In this case the diseased parts should be carefully cut away, as it is quite likely that such infected tubers afford one of the most important means of disseminating the disease from season to season, although such has not yet been experimentally demonstrated.

9. The plants should be kept well hilled-up so as to obviate the possibility of any spores being washed or blown onto the tubers through cracks in the soil before digging.

10. Wider planting than is at present in vogue should be resorted to, so as to facilitate the necessary cultivation, spraying or dusting operations.

11. Rotation of crops and burning of the diseased plant remains should be carried out, whenever possible, so as to lessen the sources of infection for succeeding crops.

12. It may eventually be found possible to prevent the disease in Certified Seed, without injury to the tubers, by dipping, immediately after digging, in certain strengths of formalin, mercuric chloride, etc., but the possibilities in that direction have not yet been investigated.

13. Never bag the tubers, if it can be avoided, in a wet condition.

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Fig. 1.—"Early Blight" or "Macrosporium Blight," due to *Macrosporium solani*, on potato foliage. *After Chupp (slightly modified).*

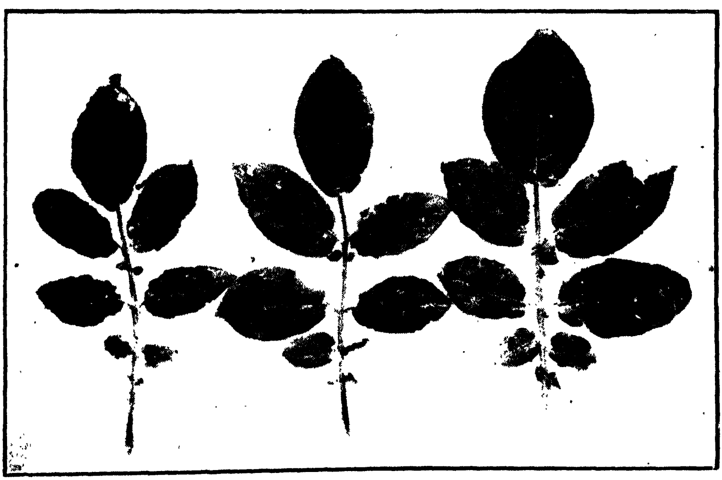


Fig. 2.—Various stages of "Macrosporium Blight" ("Early Blight") on potato foliage. *Photo by author.*

Fig. 3.—A. "Macrosporium Blight" ("Early Blight") on potato leaf showing characteristic zonation of the lesions. *After Kirk (modified).*
B. Leaflet showing zonation of the lesions.
C. Spore of *Macrosporium solani.*

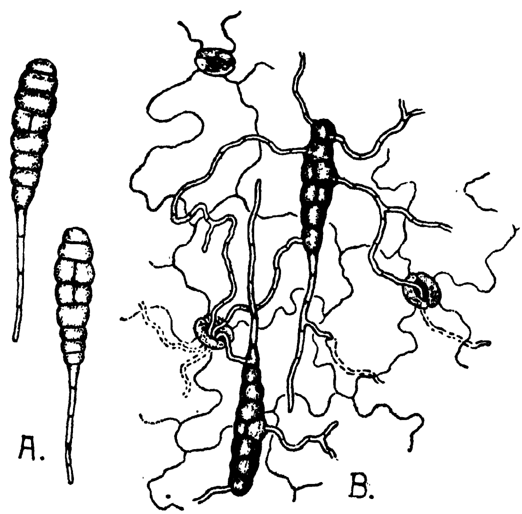


Fig. 4.—A. Spores of *Macrosporium solani.*
B. Spores of *Macrosporium solani* germinating on potato leaf. *After Jones.*

Fig. 5.—"Delaware" potato tubers showing "Macrosporium Storage Disease" due to *Macrosporium solani*. x 2/5. *Photo by author.*

Fig. 6.—"Delaware" potato tubers showing very large lesions due to "Macrosporium Storage Disease." Such lesions develop in tubers dug immature where large areas of skin are rubbed away in the digging operations. x ½. *Photo by author.*

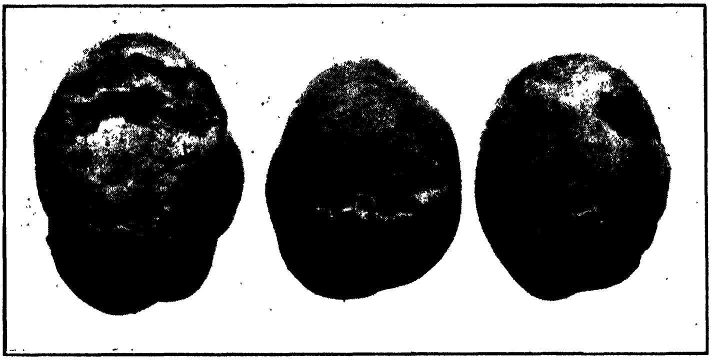


Fig. 7.—"Delaware" potato tubers showing characteristic lesions of the "Macrosporium Storage Disease." x 2/5. *Photo by author.*

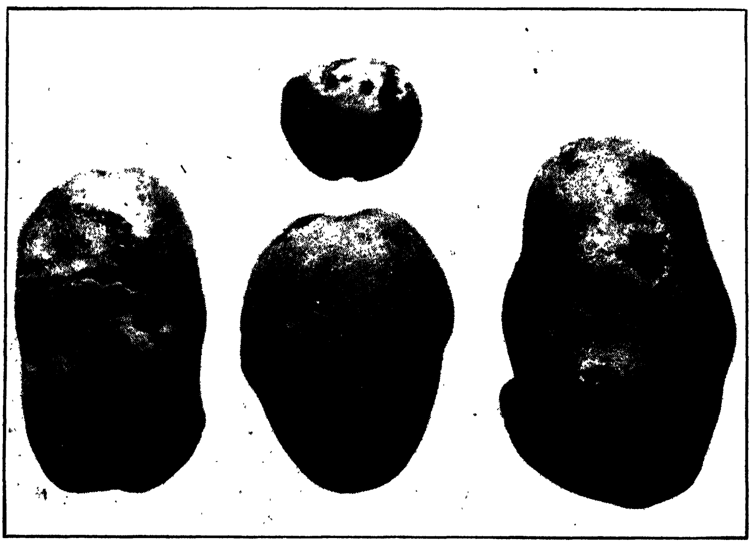


Fig. 8.—"Manistee" (top) and "Delaware" potato tubers (below), showing lesions due to attack by *Macrosporium solani.* Infection is just commencing in the tuber on the left at several places where the skin has been rubbed away. x 2/5. *Photo by author.*

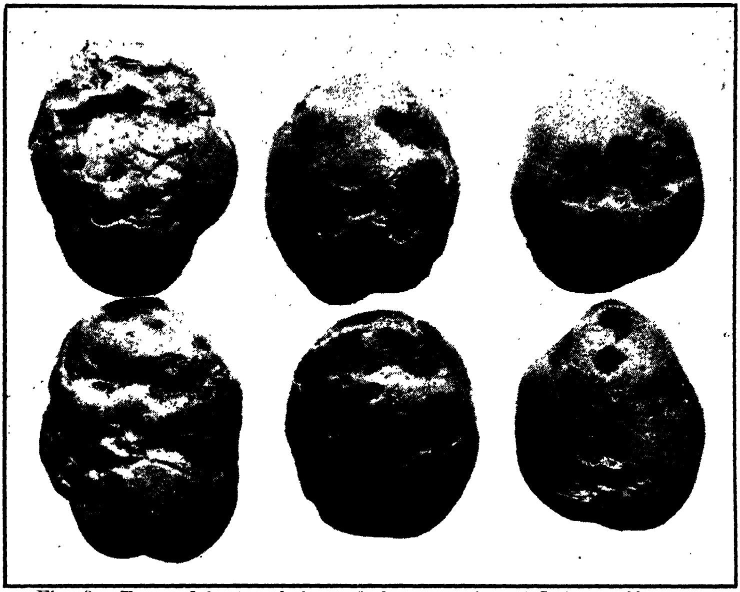


Fig. 9.—Top and bottom halves of the same three "Delaware" potato tubers, showing how serious the deterioration caused by *Macrosporium solani* may be under favourable conditions. x 2/5. *Photo by author.*

Fig. 10.—Sections of the three "Delaware" tubers shown in Fig. 9, showing the characteristic dry, dead, brown areas in the flesh beneath the surface depressions. The internal dead tissue is often, in proportion to the external dimensions of the lesions, surprisingly scanty. *Photo by author.*

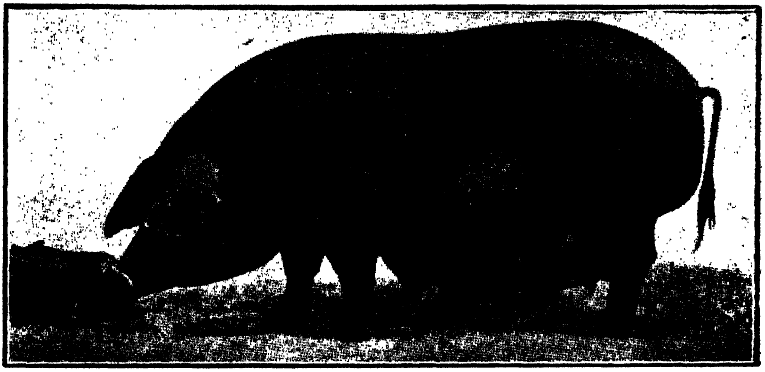
Fig. 11.—"Delaware" tubers in late stages of the "Macrosporium Storage Disease," showing secondary infection of the lesions by *Fusarium oxysporum*. In such cases the internal tissue of the tubers is soon completely destroyed. x 2/5. *Photo by author.*

PIGS AND PIG RAISING.

(Continued.)

LARGE BLACK.

Origin veiled in obscurity No evidence of mixture of breeds. For generations Large Black was the only pig known in Devon, Cornwall, Suffolk, and Essex. First herd book 1899.



A Large Black Sow.

Characteristics—

Relative size.—Large; nearly equal to Large Yorkshire and Tamworth.

Adaptability.—Excellent. Very placid and contented disposition. Particularly suited to small farmer. Good foragers—eat almost anything—are not finicky in their tastes. The condition of their skin, fineness of hair and colour are the reasons for their powers of resistance to the harsh sunlight.

Maturing qualities.—Medium.

Grazing and feeding qualities.—Excellent grazers. Respond well to feed. Good foragers.

Quality of meat.—Medium. Noted for whiteness and firmness of fat. Large carcase. Big bone.

Value for crossing or "grading up."—Excellent to improve size and litters, depth of body, grazing.

Breeding qualities.—Very prolific, large litters, good mothers.

Outstanding points—

Head.—Medium length.

Ears.—Long wide, falling over face, fine in texture.

Jowl.—Medium.

Neck.—Fairly long.

Back.—Long, broad, inclined to arch.

Sides.—Very deep.

Ribs.—Well sprung.

Barrel.—Ample capacity.

Hind quarters.—Long, wide, not drooping overmuch.

Hams.—Large and well filled.

Legs.—Comparatively short, straight, well placed.

Skin.—Fine, mellow to touch.

Hair.—Somewhat sparse, fine silky.

Objections—

Head.—Narrow, dished nose.

Skin and hair.—Coarse or curly.

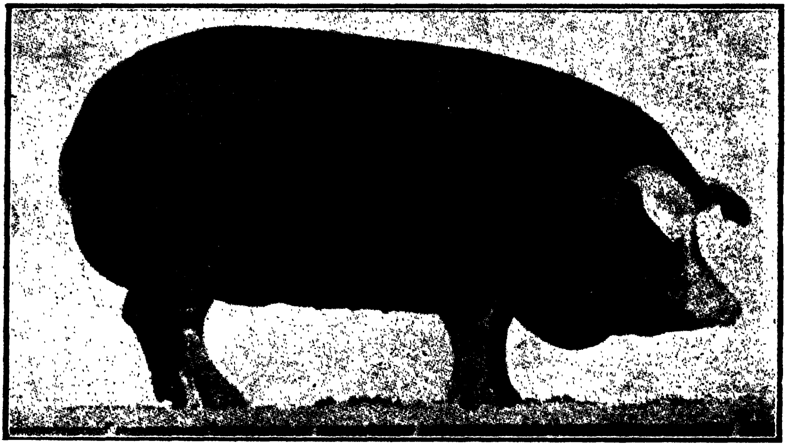
Disqualifications—

Ears.—Thick, coarse or erect.

Colour.—Other than whole black.

POLAND-CHINA.

Origin, Ohio, America. Foundation native pig of America crossed with the Russia and Big China, and later Berkshire prior to 1835. No out-cross since 1845. Original type much larger than present day.



A Poland-China Sow.

Characteristics—

Relative size.—Medium.

Adaptability.—Fairly good. Even in temperament and tractable. Quick growers.

Maturing qualities.—Most excellent. Early, probably the leading (closely resemble Berkshire); often do so too rapidly and interfere with growth.

Grazing and feeding qualities.—Require good pastures. Good doers, but require plenty of food.

Quality of meat.—Kill well. Small bone and percentage offal. Meat fine in grain and tender, but proportion of fat large.

Value of crossing for "grading up."—Cross well on large, common coarse sows deficient in compactness, requiring early maturing and improved feeding. Not suitable to cross with small sows.

Breeding qualities.—Only fair.

Principal points—

Head.—Short, wide, tapering to nose.

Ears.—Small, soft, drooping forward gracefully, not flopping.

Jowl.—Full, firm, but not over prominent.

Neck.—Wide, deep, short, arched.

Back.—Broad, straight or slightly arched, medium length.

Ribs.—Well sprung.

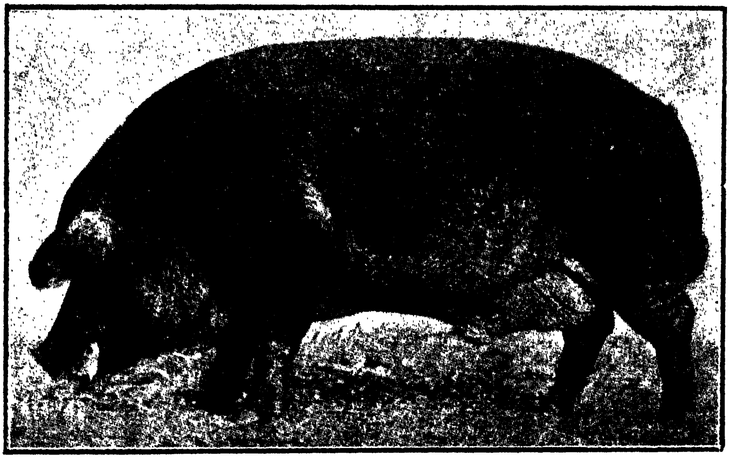
Barrel.—Smooth, firm, deep capacity, very symmetrical.
Rump.—Broad, rounded slope to tail.
Hams.—Very broad, full and well fleshed.
Legs.—Short, well set, square.
Skin and hair.—Fine, straight, plentiful.
Colour.—Black with white face, feet, legs, and tip tail. Few small white spots on body no objection.

Objections—
Head.—Dished, like Berkshire.
Ears.—Flopping too much.
Back.—Hollow, too long.
Legs.—Long, crooked, weak.
Colour.—Solid black or more than quarter white, sandy spots.

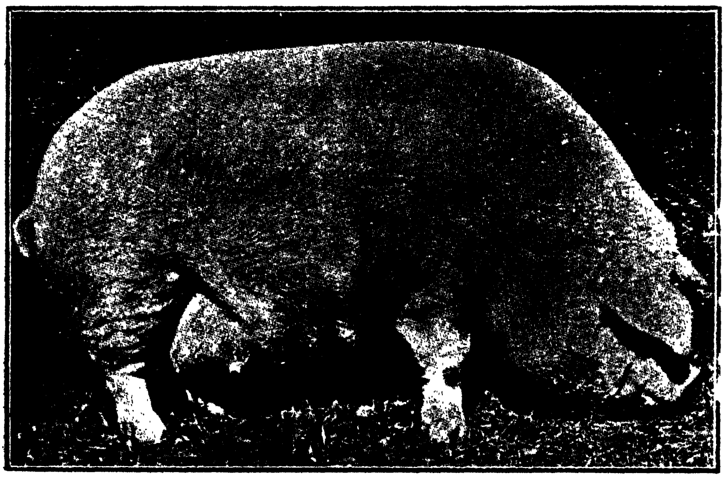
OTHER BREEDS OF PIGS.

A Gloucestershire Old Spot Sow.

A Hampshire Sow.



A Duroc-Jersey Boar.



A Chester White Sow.

BREEDING.

Grading-up and Cross-breeding.

To make pig-raising fully profitable it is essential that a good marketable class of pig be bred—breed to suit your own market. We have ample demonstration of the want of a definite purpose in breeding pigs in vast numbers of poor quality animals that are seen both on the farm and at the

bacon factories in Australia generally, and when one considers that the original pigs of Australia were imported (there were no wild pigs)—and naturally one would expect only good types of the various breeds to have been brought to Australia—we have to-day, in a great many cases, a type of mongrel pig that has degenerated very greatly, and it can only be attributed to haphazard mating, neglect in breeding, feeding, and handling. In most instances of poor type it is the result of the crossing breeds with no defined purpose—mixing them up hopelessly. We have the same thing existing in dairy cattle breeding, in many cases mixing the breeds with each successive generation—utter lack of any object or purpose in breeding—just drift—the nearest or cheapest bull or boar that can be got is used on the cows or sows without any regard for the suitability or weakness of the animals mated, with the result that there is mixed, unsuitable, unprofitable, poor type progeny; a gradual deterioration instead of advance and improvement.

In breeding dairy cows we have their milk and butter production to guide us—in breeding pigs we have the market requirements of shape, size, and meat qualities and economical early mating to aim at, and success, advancement, and prosperity will be only obtained by close attention to *breeding and feeding*.

The average pig raiser cannot at a moment's notice dispose of his mongrel, low-type sows and replace them with the desirable profitable kind. He cannot afford to, but he can start out on a new forward policy of improving his stock, and the first thing to do, without any doubt, is to secure a pure bred, well-shaped boar of a breed suitable to mate with the sows. The aim is to remedy the faults of the sows in their litters—to get bigger and better litters—better shapes, better market quality meat, and vigorous healthy economical growers. The boar will do this, but the boar must be pure bred and of good type, and the only guarantee of purity is registration in the Herd Book. Purity is prepotent, because there is a preponderance of one blood. The progeny of a pure bred boar mated to mongrel sows are stamped with their sire's characteristics. They are better shaped, have better constitutions, are better fleshed, and are better doers. This means higher prices per lb. and cheaper feeders.

The mongrel or cross-bred boars being used are the principal cause of the limited profits in pig raising, and are prejudicial to the industry. The low-typed mongrel boar is a calamity.

"Grading-up" means using pure males of one breed by a succession of matings, starting with mongrel females and continuing it without deviation—a concentration of one blood is obtained. The mongrel blood is bred out and a fixed type obtained. To improve on the low type mongrel pig select the best type young sows from each generation, and mate to pure boars of the breed commenced with—do not change the breed of boar—if you do you start downhill again, and often slide right to the bottom in one step. By a definite policy of "grading-up," such as has been outlined, a pig breeder builds up good type and quality, shapely, fast growing and profitable market pigs. His stock are worth looking at, and they are money makers, and the man has achieved something to be proud of—he has improved his herd.

"Grading-up" does not require capital—beyond the cost of a good male to start with. It, however, requires a decision of breed, a steadfastness of purpose, care in mating, handling, and culling, and success is assured.

The Pure Berkshire Boar is a great favourite to "Grade up."

Cross-breeding means mating pure males of one breed with pure females of another breed. It does not mean mating one cross-breed with another cross-breed, or cross-breed with mongrel, or mongrel with mongrel. In cross-breeding we obtain results that can be depended upon with a considerable degree of reliability for uniformity or similarity of type, but when the crossing is further crossed or criss-crossed the results are most irregular and unreliable. Cross-breeding is often resorted to for the purpose of meeting the market requirements as regards type of meat, size of carcase, and to increase prolificacy. For instance, we have of the different pure breeds the following tendency to weakness:—

Berkshire.—Inclined to become over-fat; smallish litters; indifferent mothers.

Tamworth.—Slow maturers; unshapely sides and hams; large percentage of bone and offal.

A Crossbred Berkshire-Middle Yorkshire.

Large Yorkshire.—Inclined to over-fat; not suitable for hot climates; large percentage of bone and offal; slow maturers.

Large Black.—Inclined to coarseness; slow maturers; large percentage of bone and offal; over-fat.

Poland-China.—Inclined to over-fat; small litters.

FOR VARIOUS MARKET REQUIREMENTS THEY RANK AS FOLLOWS:—

For Pork.—Small Yorkshire, Poland-China, Berkshire, Mid. Yorkshire.

For Bacon.—Berkshire, Mid. Yorkshire, Poland-China, Tamworth, Large Black.

Pork (for export).—Berkshire, Mid. Yorkshire, Large Black, Tamworth, Large Yorkshire.

Bacon (for export).—Berkshire, Yorkshire, Large Black, Tamworth, Poland-China.

As Rustlers (Australian conditions).—Tamworth, Large Black, Berkshire, Yorkshire, Poland-China.

As Grazers (and self-feeders).—Berkshire, Large Black, Yorkshire, Tamworth, Poland-China.

Stye feeders.—Poland-China, Yorkshire, Berkshire, Large Black, Tamworth.

For prolificacy and nursing young.—Tamworth, Large Black, Yorkshire, Berkshire, Poland-China.

Early maturing.—Berkshire, Poland-China, Yorkshire, Large Black, Tamworth.

Grading-up Boar or crossing.—Berkshire (stands out in Australia), then Mid. Yorkshire, and Tamworth.

The Ideal Porker (small to medium).—Pure Yorkshire, Berkshire, Poland-China. Cross-bred Berkshire—Yorkshire. Poland-China—Yorkshire. "Graded-up" Berkshire. Mid- Yorkshire, Poland-China.

Baconers (small to medium).—Pure Berkshire, Yorkshire, Tamworth. Crossbreds: Berkshire × Berkshire—Tamworth; Berkshire × Berkshire—Large Black; Berkshire × Yorkshire. "Graded-up" Berkshire, Yorkshire, and Tamworth.

Porkers (large).—Pure Yorkshire, Berkshire. Cross-breds: Berkshire × Mid. Yorkshire; Poland-China × Yorkshire. "Graded-up" Berkshire, Yorkshire, Poland-China, and Large Black.

Baconers (large).—Pure Berkshire, Yorkshire, Large Black, Tamworth. Cross-breds: Berkshire × Berkshire—Tamworth; Berkshire × Berkshire—Large Black; Berkshire × Yorkshire. "Graded-up" Berkshire, Yorkshire. Tamworth, and Large Black.

In placing the various pure breeds, cross-breeds, and grades an endeavour has been made to advise pig-raisers in regard to all aspects of marketing, climatic conditions, and breeding in order that they may breed a class of pig that is likely to be most suitable, the main considerations of which are quality and percentage of meat, suitability for particular purpose the pig is to be killed, blending of fat and lean, shape and size of side, ham, etc., early maturing, hardy, thrifty, prolific, and nursing. In a hot climate like ours weighty fat sides of bacon are not favoured. Retailers prefer a medium side, well streaked with lean.

The writer's experience points unquestionably in the law of averages under West Australian conditions that the pure Berkshire, highly-graded Berkshire, pure Medium Yorkshire prove the best porkers, and for baconers the Berkshire-Tamworth Comeback, viz., Berkshire crossed with Berkshire-Tamworth sow, stands pre-eminent, with pure Berkshire, highly-graded Berk-

shire in that order. In regard to the Berkshire-Tamworth Comeback it should be bred as follows:—Pure Berkshire boar mated with pure Tamworth sow (both of good type), and sows selected from this mating and bred back to Berkshire boar—the progeny to be marketed; additional brood sows to be bred Berkshire boar crossed with Tamworth sow. Thus a pig-raiser would start out and procure a pure Berkshire boar and a pure Tamworth sow or sows, and raise his own breeding sows to breed back to a Berkshire boar unrelated to the sire of the brood sows. Excellent results (as baconers) have been seen by using a Large Black sow in place of the Tamworth, or what is called a Berkshire-Large Black Comeback.

It is to be remembered that in the case of the pure Berkshire often too much fat in the bacon, smaller litters, and deficiency in nursing are obtained. In the highly-graded Berkshire much depends upon whether the original females had a percentage of Tamworth or Large Black blood, remembering always that the Tamworth and Large Black impart prolificacy, are excellent mothers, good foragers, have length and depth of sides, and in the case of the Tamworth increased percentage of lean in the rashers.

It will be readily understood that it is most difficult to dogmatise in this direction, and that the results will be varied according to the market requirements, climatic, pasturage, and forced feeding conditions, and types of boars and sows used.

PROGRESS REPORT.

Blowfly Survey of the South-West.

L. J. NEWMAN, F.E.S.,
Economic Entomologist.

The object of this investigation is to determine the abundance, distribution and seasonal appearance of the different species of blowflies, and to demonstrate the effectiveness of luring and trapping the flies.

The trap used was the West Australian Blowfly Trap. At each of the State Experiment Farms and in the insectary grounds, Perth, a trap has been installed.

With the assistance of the farm managers the capture each month is collected and forwarded to the entomological laboratory. Here the total capture is determined, the species of flies identified and recorded, and the preponderance of any species noted.

Appended hereunder in tabulated form are the results of the progressive captures to date.

It has been observed that the lure after ten days fails to prove attractive to true blowflies, but has a very strong attraction for other species of Muscidae, which includes the common house and stable flies.

It is possible that the relatively low percentage of blowflies shown in some instances in the following table is due to this fact. It is therefore advisable to renew the lure every ten days and at the same time to empty the trap of the capture as the flies are more readily enticed up the cone, into the top chamber, if light is permitted to penetrate.

When the flies are allowed to accumulate around the cone, they cut off the light, which is essential, and thus many flies may escape capture by returning through the ingress openings.

At the conclusion of the survey, which is to occupy twelve months, detailed results, giving the numbers and percentages of each species captured each month at each station, will be published.

Month.	Perth.		Perenjori.		Merredin.		Chapman.		Wongan Hills.		Avondale.		Salmon Gums.	
	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.	Total Flies.	Total Blowflies.
April ...	29,000	27,978	30,000	26,400	20,000	5,200	1,000	900	...	...	...	...	...	...
May ...	7,200	6,513	36,000	36,000	1,760	1,026	...	...	...	...	...	...	40,000	Trace.
June ...	5,200	2,969	8,000	6,936	7,000	2,296	21	20	3,750	375	...	...	...	...
July ...	3,553	1,121	13,000	11,885	437	308	1,320	1,287	353	215	...	...	32,000	Trace.
August ...	3,285	1,620	36,000	35,748	7,000	6,223	4,500	4,383	17,000	10,013	5,000	4,305	40,000	8,150
September	33,000	14,784	62,000	51,600	22,000	16,340	15,000	10,635	38,000	9,300	16,500	15,675	...	...
October ...	43,000	17,558	60,000	52,680	33,000	19,899	12,000	7,848	30,000	8,540	11,500	10,925	70,000	1,460
Total ...	124,238	72,543	245,000	221,249	91,197	51,2[illegible]2	33,841	25,073	89,103	28,443	33,000	30,905	182,000	9,610

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder Smith & Co., Limited, Perth:—

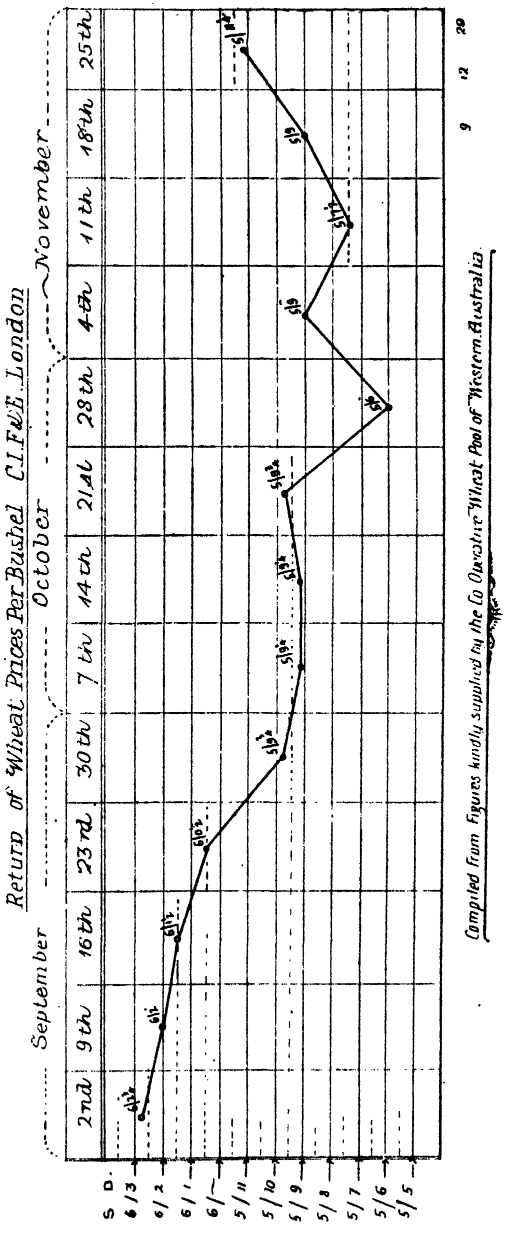
COMPARATIVE YARDINGS OF STOCK YARDED AT METROPOLITAN FAT STOCK MARKETS DURING SEPTEMBER, OCTOBER, AND NOVEMBER, 1929.

—	September.				October.					November.			
	4th	11th	18th	25th	1st	8th	16th	23rd	30th	6th	13th	20th	27th
Sheep and Lambs	13289	10460	12,613	12,546	10,076	13,401	17,087	16,290	17,714	20,318	15,189	14,738	9,499
Cattle ...	702	715	802	956	519	673	470	684	636	823	690	797	719
Pigs ...	481	428	563	674	668	558	813	744	616	756	707	863	661

COMPARATIVE VALUES PER POUND OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS DURING SEPTEMBER, OCTOBER, AND NOVEMBER, 1929.

—	September.				October.					November.			
	4th.	11th	18th	25th	1st	8th	16th	23rd	30th	6th	13th	20th	27th
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
Mutton ...	7	7	*4½, 6½	*4½, 6½	*5, 7	*5, 7	*5, 7	* 5, 7	*4½	* 4½	4½	4½	5½—
Beef ...	6	6½	6	6	6½	7	8½	8	7½	6	6¾	7½	8
Pork ...	10½	10¾	11	11	11	11½	11½	11½	11½	11½	11½	11½	11½
Bacon ...	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9½	9

* Shorn.


Return of Wheat Prices Per Bushel C.I.F.&E. London
September
October
November
2nd
9th
16th
23rd
30th
7th
14th
21st
28th
4th
11th
18th
25th
S. D.
6/3
6/2
6/1
6/-
5/11
5/10
5/9
5/8
5/7
5/6
5/5
Compiled from Figures kindly supplied by the Co-Operative Wheat Pool of Western Australia.

MARKET REPORT.

Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth, have supplied us with the following information regarding chaff available at the metropolitan chaff and grain auction sales held in Perth for the period September to November (inclusive). In all cases the prices quoted are for f.a.q. to prime wheaten chaff, packed in new bags:—

	Quantity.	Maximum.	Minimum.
	tons.	per ton.	per ton.
September	1,150	£6 0 0	£5 10 0
October	1,200	£5 15 0	£5 0 0
November	1,450	£5 10 0	£4 15 0

It will be noticed that the market was at its lowest point in November, as low as £4 15s. per ton being accepted. The cause of this was the usual temporary glut generally experienced at this time of the year, most growers of hay being anxious to cut and sell from the stook and consequently with more chaff available at that period than is required for consumption, low prices have to be accepted. At time of writing the position is brighter, the market being steady at £5, and we have no doubt that better prices will rule in the near future.

Oaten Chaff.—A fairly large quantity of prime quality oaten hay was cut along the Eastern Goldfields line this season, and farmers being anxious to sell this from the stook resulted in the market being more or less glutted. During the past few weeks prime samples have been selling as low as £4 10s. per ton. This is an unpayable price from the growers' standpoint and we believe that in a few weeks when stook cutting is completed, values will improve.

Oats.—Heavy supplies have been available during the period under review and with a poor demand, consignments have been difficult to quit at low prices, good heavy feeds selling at from 2s. 2d. to 2s. 3d. per bushel; mediums, 1s. 9d. to 2s. At time of writing consignments are not arriving so freely, and the market has improved a little, good heavy feed Guyras and Algerians being worth 2s. 5½d. to 2s. 6½d.

Wheat.—This market has fluctuated considerably, there being a firm demand at the moment for f.a.q. at around 5s. 3d. per bushel; other qualities at lower prices according to sample.

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	SEPTEMBER, 1929.						OCTOBER, 1929.						NOVEMBER, 1929.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	72·7	85·3	45·4	38·6	0·73	1·68	76·6	90·8	50·2	43·2	0·35	0·99	79·6	93·6	55·0	47·0	1·06	0·26
Geraldton	70·9	88·8	50·6	44·2	0·65	1·39	72·6	91·0	55·1	44·4	0·27	0·71	74·3	94·0	59·7	53·0	0·63	0·25
Walebing	69·3	82·8	40·8	35·0	0·74	2·21	74·3	91·0	46·8	41·5	1·49	1·35	79·0	95·0	52·4	44·3	1·16	0·54
Perth	67·3	82·5	48·5	43·0	2·82	3·45	71·3	85·5	52·1	41·9	1·09	2·21	73·7	85·8	57·0	52·4	1·12	0·79
Kalamunda	67·5	79·6	46·5	39·9	2·08	4·77	71·6	87·0	49·7	39·9	2·34	3·24	69·6	83·0	53·3	49·0	1·30	1·05
Bunbury	63·9	70·0	44·4	36·0	0·97	3·76	67·4	81·4	48·7	35·8	0·77	2·46	70·7	82·0	54·1	44·0	1·16	1·02
Bridgetown	66·4	78·2	38·9	31·0	1·89	3·99	72·5	89·0	42·6	33·0	1·87	3·06	76·4	87·2	19·7	39·0	2·23	1·12
Albany	63·8	81·0	48·0	39·0	3·06	4·15	64·7	83·0	51·0	43·5	2·06	3·27	68·1	79·5	54·6	48·0	6·71	1·33
Merredin State Farm	70·3	87·1	40·9	32·8	0·13	0·99	75·6	91·0	47·3	34·8	0·35	0·80	78·5	99·2	54·2	46·9	2·20	0·35
York	70·5	83·6	39·6	34·0	0·33	1·63	75·8	92·0	45·5	36·0	1·50	1·04	78·7	93·0	52·9	47·0	0·74	0·43
Narrogin State Farm	66·2	78·8	40·7	33·2	1·67	2·34	70·7	88·1	42·8	33·1	0·75	1·48	75·1	89·0	50·7	42·0	1·81	0·55
Katanning	65·3	80·0	41·9	33·3	0·86	1·98	71·2	88·0	44·3	35·4	1·28	1·60	74·3	86·7	50·9	43·7	3·55	0·62
Cape Leeuwin ...	62·2	70·5	51·4	44·8	1·80	3·48	64·4	75·0	53·1	46·0	1·46	2·95	68·0	72·5	57·5	51·2	2·29	1·22

PRODUCERS' MARKET REPORT.

The Producers' Markets, Ltd., report as follows for quarter ending 7th December, 1929:—

Good supplies continued throughout; all prime lines of all variety realised good prices. Up to November we were favoured with large consignments of tomatoes from Geraldton, all prime realising good prices. Owing to dry weather conditions this year, the tomatoes were not up to previous years in quality, large portion being small. Local tomatoes since increased in volume. Supplies are heavier than previous year, all prime lines selling to a good demand. Lemons were unsettled only towards the end, same increasing in volume, also quantity and price, selling up to 15s. three-quarter bushel. Navels and oranges in the early part were steady, owing to weather conditions being wet brought forward plenty of windfalls. About the middle of November prices began to improve, and have remained firm, navels realising up to 22s. 9d. bushel, and oranges 23s. 6d. Loquats are falling off in volume; all prime lines realised good prices throughout this season. There have only been a medium supply of Cape gooseberries forward, these realising good prices throughout. All prime strawberries sold well. There are a lot of poor quality berries coming forward. Commencing in November, cherries have been increasing in volume, all prime selling to a good demand. A good lot continue to come forward wet and over-ripe, which appears to us are packed much over-ripe and will not carry. There has been good supplies of apples forward throughout. Prime G. Smith and Yates have realised highest prices. All prime lines of other varieties realised well. During the whole period small apples were forward in volume, which had a tendency to keep all prime lines 15s. to 23s. 6d. Stone fruit coming forward heavy also plays a big part in keeping apples steady. Apricots commenced on about 13th November and have increased in volume, small fruit being heavily supplied, and towards the end sold down to 2s. 3d. A good lot forward are showing a lot of shot hole. Large and clean fruit realised good prices. Peaches are also heavily supplied, only prime lines being in demand, small fruit selling very cheap. Towards the end grapes made their appearance, realising satisfactory prices. Only a medium supply of plums forward; only ripe and coloured lines were favoured.

VEGETABLES.

Supplies of vegetables for the month have been consistently heavy. Metropolitan potatoes have shown a sharp decline in values owing to the collapse of the markets in the Eastern States. Country growers were more fortunate in securing the higher values obtained before the collapse. Pumpkin values have been steady, prime lines particularly being in good demand. Inferior sorts have been hard to quit, and value for these are never high. It would be better for growers to market these early in the season, as the demand for inferior quality pumpkin is rarely good. Swedes have been plentiful; values have been low, and stocks hard to quit at any figure at all. Cabbage has fallen off in quantity a little, but values have firmed, and good quality lines in good demand. Rhubarb heavily supplied, and values are easier with the marketing of the stone fruit crop. Peas have been plentiful, and values steady. Beans plentiful, both runner and French, and values

soon fell to glut level. White onions, particularly Globe, are in demand, and prime samples of the right size are selling well. Brown onions are also selling well, and prime dry lines are scarce. Marrow are heavily supplied now to a weak demand. Cucumbers also are heavily supplied, and values are firmer now that the tomato crop is in full swing. Bunch lines have been heavily supplied and values have been low for all lines. Lettuce of good quality has been in good demand, and values firm for these; inferior lines plentiful, and values for these low.

EGGS.

Heavy supplies came forward early in September to a reduced market, prices being 11d. at auction and 1s. 2½d. for export. During September prices advanced to 1s. 2d. at auction. The same price appertained during October, with advanced price during November to 1s. 4½d. for best quality metropolitan eggs.

POULTRY.

During September heavy supplies to a good demand, with values not quite equal to late August sales. Turkey gobblers were short in supply, and realised up to 44s. During October prices were slightly easier. November prices were on a par with October, with the exception of Turkey gobblers and cockerels, which were keenly sought after; no high value ruling. Roosters and aged light hens plentiful, and values low. At the end of November cockerels and turkey gobblers still maintained high values. Other lines hard to quit at satisfactory prices. Far too many aged and half-grown birds being marketed.

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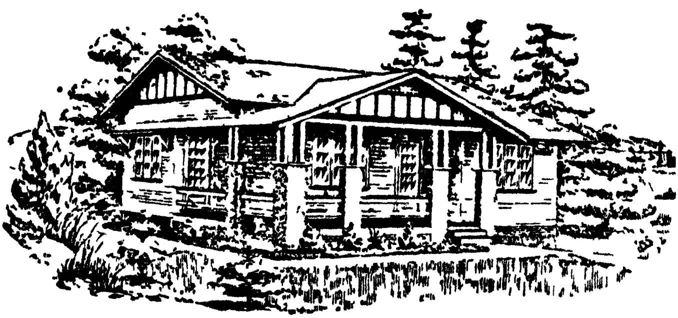

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